THE METAL INDUSTRY

WITH WHICH ARE INCORPORATED

THE ALUMINUM WORLD, THE BRASS FOUNDER AND FINISHER, THE ELECTRO-PLATERS REVIEW, COPPER AND BRASS

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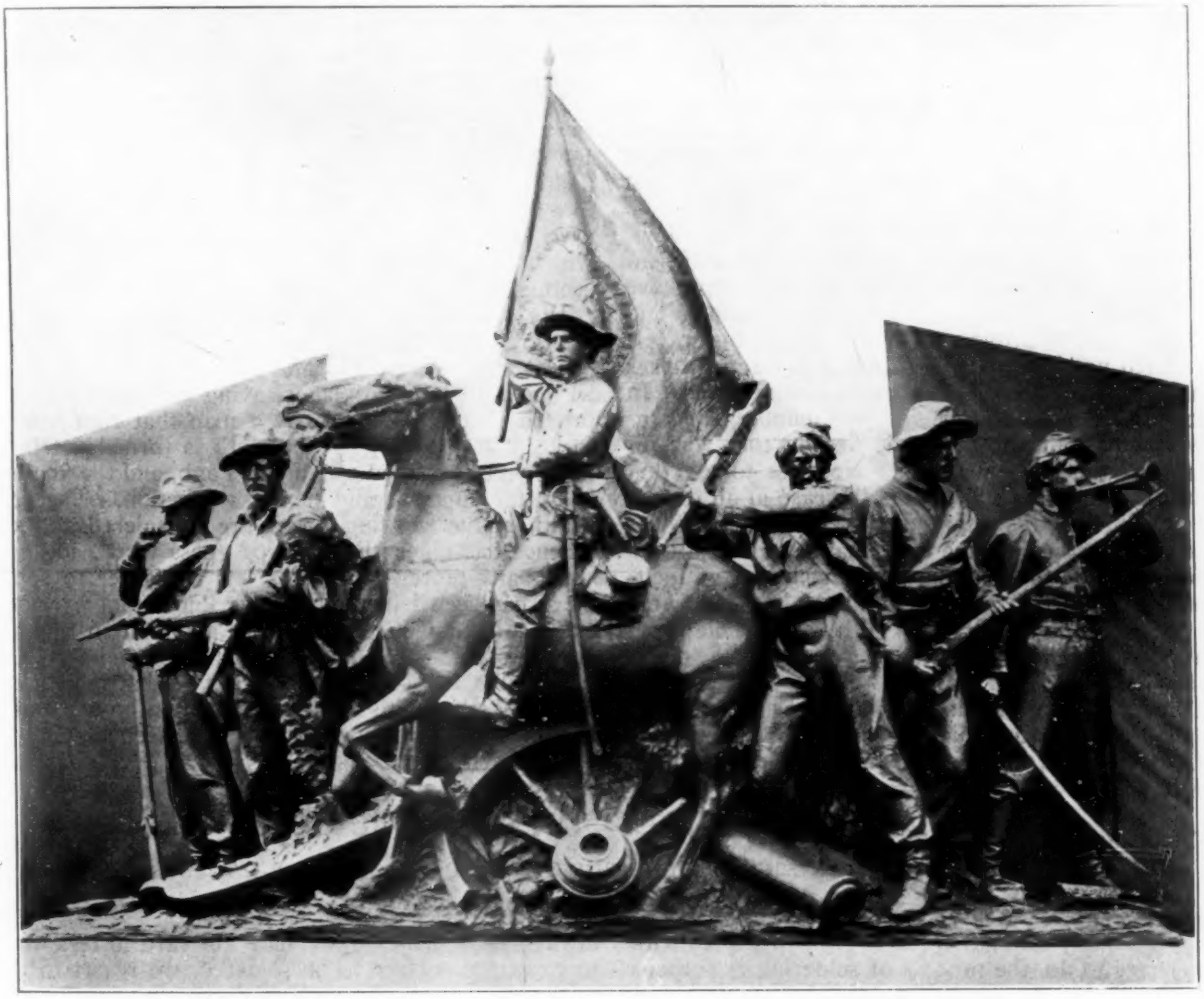
STATUARY AND ORNAMENTAL CASTINGS

A FEW REMARKS REGARDING MODERN PROGRESS IN BRASS FOUNDING.

BY WILLIAM N. NELLY.

Remarkable is the progress that has been made, and wonderful are the steps that have been taken towards the perfection of the art of casting sculptural and ornamental work. True that this branch of foundry work is left entirely to the common sense and experience of the man actually doing the work. And this point I want to emphasize, in as much as it gives ample chance to fall into primitive and crude methods, as it depends entirely upon



BRONZE GROUP FOR VIRGINIA MONUMENT AT NATIONAL GETTYSBURG PARK.

The Virginia Memorial Commission have just accepted the bronze group shown above, which will form part of the Virginia monument at the National Gettysburg Park. The committee was appointed several years ago to arrange for the erection of the monument which would perpetuate the memory of the men enlisted in the Confederate cause from Virginia. The group shown above is part of the design which was submitted by Mr. F. William Sievers, and when completed will form one of the most unique monuments ever conceived, and will differ in many respects from the others of the group which will form a part of the Southern memorial. It will consist of a granite shaft on the top of which will be placed the figure of General Robert E. Lee, the native son of whose character and bravery Virginia is so justly proud, mounted on his favorite horse "Traveler." Below and in front of General Lee the group which is shown in the picture will surmount a granite pedestal 16 feet high. The group is one of the largest and most important that have been cast in recent years; its length is 16 feet, its height 18 feet and it is 5 feet deep. The casting of the group was entrusted to the Tiffany Studios, New York, whose artisans are to be congratulated upon the excellent result obtained and on the remarkable finish they have produced.

the man's brain, and his amount of intelligence, to find the way out of the thousand and one difficulties encountered in the handling of a piece of casting, large or small. I will illustrate this with an example.

Of the factors which play an important part in the making of lost wax molds, brick dust is the most important. Fifty years ago brick dust was obtained by rubbing two bricks, one against the other. Very slow process, indeed. Then came a man who required brick dust in large quantities, and he made an innovation and was looked down upon for it. He employed laborers, whose task it was solely to pound a certain kind of bricks in mortars, day in and day out. The man refused to install in his foundry a grinding mill, simply because he was convinced that the hand-pounded brick dust was the only kind that would give results.

In baking molds, charcoal or wood were believed to give the only kind of heat for the purpose. The idea of using hard coal, coke or oil to give a uniform kind of heat was discarded, and the fear of innovation kept the man of up to ten years ago from using hard coal, coke or crude oil from their ovens. A model of a statuette, for instance, was believed to be an impossibility for anybody to cast in one piece, so the arms, legs, head and the base had to be cast in as many pieces. Lately it has been found that the way to cast the most intricate statuette is in just one piece, and the results have been of the best kind.

A few words about the melting of bronze and alloys. Superstition has made foundry men of the last half century do innumerable stunts, unnecessary hardships have ruined the life of those who paid an enormous and uncalled for price to progress. The writer in his travels had witnessed not long ago the casting of large bronzes where a ton or more of molten bronze was required. In one instance an extra furnace for two number 150 crucibles was made out of one single firebox that was intended to heat up a drying oven. Needless to say that the firebox had no direct flue, as is the case in all drying rooms. The fire in this impromptu melting furnace was started eight hours before the final quantity of metal was needed. Think of the fun the man in charge of melting this particular 800 pounds of metal had in charging the pots, tending the fire, etc. Why, the whole room was heated to a red heat, almost, and every time the metal needed attention, the poor man had to enter this hell. In another case, a large quantity of metal was melted in a natural draught furnace, which after it had been charged with 6,000 pounds of bronze and the fire started, was to melt the whole business in ten hours. The mold was about twenty feet away from this furnace, so a ladle was hung from the roof half way between the furnace and the mold, because no crane was to be found in this foundry. When the time came to tap the furnace, the ladle was drawn close to the spout by means of two ropes made fast to the two handles of the ladle, the ropes being held by an army of men. So far so good. No sooner had the metal commenced to gush out of the furnace in a white hot stream, and some of it spilling out and burning some planks so that the men got confused, when the word was given to slacken the ropes and draw the ladle toward the mold; the men had fairly lost their heads. and when the metal was poured from the ladle, and the basin was half filled, ready to take the two plugs out, the men with a desperate jerk hit the basin with the ladle, knocking a portion of it off, and the metal began to spill and jump in the air, falling down again, hitting all present. Two brave molders pulled the plugs, the foreman, who was at the ladle, thundered to the men to hold on to the ropes, the contents of the ladle were poured as best as possible in the mold; needless to say that the casting was half spoiled.

It is not an uncommon sight in some parts of Europe to see men taking turns at a hand propelled blower used for the purpose of supplying the air to a combination melting furnace, let us call it so, which is made by a vat-like fire-brick structure about sixteen feet long, two feet wide, three feet deep, holding about eight or ten crucibles, which compose one of the charges required for a large casting.

We owe a lot to the progress of today, where a man can do away with all that old-fashioned, slow, killing manual labor. We have gas, and oil furnaces of all capacities, we have all kinds of labor-saving devices, and we have proved that it does not pay a man that runs a business to keep in ignorance. The work is turned out in quantities never dreamed of ten years ago, and the final output is by far superior and nearer perfection. The life and health of the working forces are considered and spared. Science has taken the place of guess work, nothing is a secret any more, which was left by father to son. No more haphazard methods, if we know that by casting a statue of ten feet in two pieces and that in time on account of shrinkage and expansion from cold and heat, the joint will show, science has taught us that if we weld the joints together with a stream of molten bronze and make the pieces one, no more joint will be seen by the generations to come.

SOLDERING FLUXES FOR SOFT SOLDER *

AN ARTICLE DEALING WITH RESULTS OF EXPERIMENTS WITH VARIOUS FLUXING MATERIALS.

By W. ARTHUR.†

Among the many familiar metallurgical processes with which we have to do, the process of soldering is perhaps the most familiar. As ordinarily defined it is a process whereby two pieces of metal are joined by another metal or alloy, having a lower melting point than the metals joined.

That the metals soldered together may be securely held by the solder it is necessary that there be more than mere adhesion between the solder and the metal. There must be an alloy formed between the metal and the solder. In order that this alloy may be formed, the surface of the metal must be entirely free from any foreign substances; as oxide, oils, or various solid matter. Since it is not always convenient, or we may not care to take the time to clean the surface to be soldered, we resort to the use of various chemicals to clean the surfaces.

The flux selected, in any particular case, is determined by the nature of the work. If ordinary tin-plate, galvanized iron, sheet copper, or brass is to be soldered, the ordinary fluxes as ammonium chloride, zinc chloride or resin may be used. But if the work is something more delicate, as the soldering of 10 x 20 mil zinc wires, in fuse plugs, the effect of the corrosion of zinc chloride on the zinc wires must be considered.

It is necessary in many instances to use a non-poisonous flux, as a poisonous flux should not be used in soldering fruit or meat tins. In a great many operations it is impossible to keep the soldering flux from coming in con-

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†General Electric Company, Schenectady, N. Y.

tact with the operator's fingers, or occasionally spattering in the face.

The rapidity with which a flux acts is an important factor in its usefulness. If the flux be in the form of a dry salt, a comparatively large amount of heat may be necessary to melt it. If an aqueous solution be used, an additional large amount of heat must be used to evaporate the water, thus slowing the rate of action by cooling the parts to be soldered. This effect is negligible in most instances, but where it is necessary that the solder

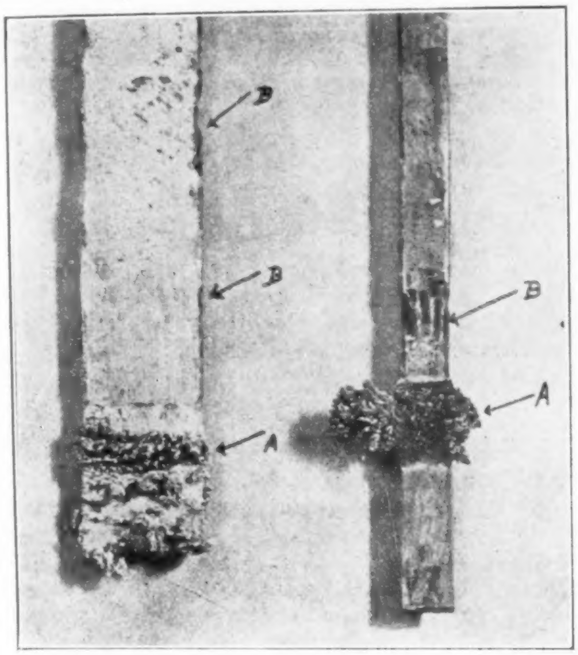


FIG. 1—STRIPS OF ZINC WHICH STOOD IN ZINC CHLORIDE SOLUTION SIX HOURS. PART BELOW DEPOSITED ZINC WAS UNDER UNDISSOLVED ZINC CHLORIDE. A—DEPOSITED ZINC. B—EROSIONS, OR WHERE ZINC PASSED INTO SOLUTION.

attach itself within a fraction of a second it becomes quite important.

If the flux does not require melting, but is a liquid, the action is much more rapid, as no time is required for the surface to be covered, and no heat is used in fusing the salt. Further, the excess flux, which should always be present, readily flows out of the way.

Zinc chloride has several properties which makes it a valuable soldering flux for most work. It is only with the greatest of difficulty that it can be obtained as a dry salt, and when exposed to the air becomes liquid in a few minutes. When used as a flux it remains a liquid even at the temperature of molten solder; thus being in a condition to act upon the oxides very readily. It possesses other properties which make it undesirable for much work. Zinc chloride is poisonous, and should not be used in soldering fruit or meat tins. It is exceedingly corrosive to the skin, and when left upon it fcr a few minutes produces severe burns. It also has an action on zinc which makes it useless for soldering small zinc wires in fuse plugs. If low capacity fuse plugs be made, using zinc chloride as a flux, the small zinc wires, such as shown will be found to be completely eaten through within a few weeks. Sometimes in a few days.

This corrosion phenomena is fairly well illustrated by the behavior of a strip of zinc in a test tube filled with zinc chloride solution; with a small amount of undissolved zinc chloride at the bottom of the tube. (See Fig. 1) Just above the undissolved zinc chloride will be seen a spongy mass which is zinc thrown out solution. Just above this mass (see Fig. II) can be seen the roughened surface of the zinc where the metal passed into solution. If a strip of zinc with a small piece of solder on its surface be immersed in a strong solution of zinc chloride and allowed to stand a few days, the zinc will show considerable erosion next to the solder. If a strip of zinc, such as used in the fuse plugs shown, have a small amount of zinc chloride solution left from the soldering operation, an action similar to that just described will take place. An electric current will be started in the direction away from the solder. Due to the action of the chloride on the oxides present, the solution may be a trifle weakened next to the solder; this too would assist in giving a current away from the solder. Consequently, we find the zinc being eroded next to the solder, and piled up a short distance away.

An aqueous solution of ammonium phosphate was tried as a flux and worked quite well on tin, copper, brass or zinc, (but not well on iron), where delicacy of operation and speed are not to be considered. But where a quick fluxing is necessary, it is not successful, as too much heat is necessary to evaporate the water and melt the salt. It has the advantage, however, of being non-

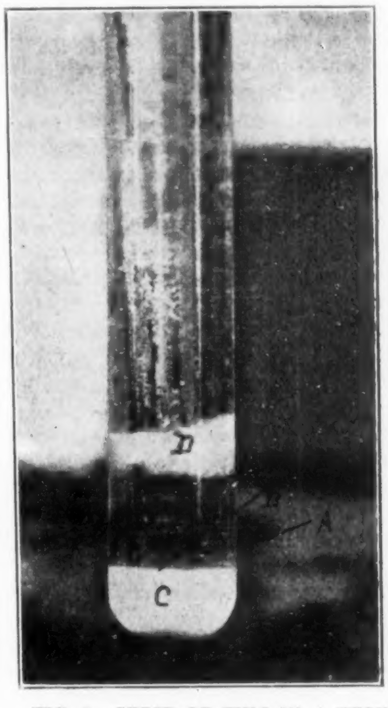


FIG. 2.—STRIP OF ZINC IN A TEST TUBE FILLED WITH ZINC CHLORIDE SOLUTION. A—DEPOSITED ZINC. B—EROSION OF ZINC. C—UNDISSOLVED ZINC CHLORIDE. D—ZINC HYDROXIDE.

poisonous and non-corrosive, and does not tarnish copper or brass.

Lactic acid and ammonium lactate were tested as to their fluxing qualities, and were found to be splendid fluxes. Equal in every particular to zinc chloride, but in a few hours showed a tarnish if used to solder brass or copper. The reason for the ready tarnishing is that lactic acid and ammonium lactate react with copper oxide in the cold. Neither of these fluxes are corrosive or poisonous in any way.

Resin, either as a powder or an alcoholic solution, is a splendid flux where speed is not required. But it has the undesirable property of leaving a sticky, gummy mass after the evaporation of the alcohol, which is quite a hindrance in some kinds of work.

SPOTTING-OUT AND SILVER PLATING*

An Investigation Into the Causes of This Troublesome Phenomenon and Some Suggestions for Its Prevention.

C. F. Burgess and L. T. Richardson.†

(Concluded from November.)

On a perfectly polished brass surface cavities may be formed by the adhering gas bubbles. These bubbles may come from the pickling or cleaning solution, or they may be formed while in the plating baths. As the plated deposit grows up around these bubbles, the cavities are thus formed, which may allow the entrance and inclusion of the solution. If such cavities are largely responsible for spotting-out, further attention should be concentrated on this particular feature. It is common practice to plate nickel upon the brass before the deposition of silver, and it is possible that the cavities due to bubbles may decrease by omitting the nickel layer.

On the belief that inclusions of cyanide solution may be a prominent cause of spotting out, some properties of cyanides were studied and it is believed that the data thus obtained are suggestive of certain remedies or mitigative methods which may be followed.

All cyanide or silver plating solutions have a certain amount of free cyanide, an excess above that required for taking the silver cyanide into solution. This excess amounts to a fraction of an ounce—to several ounces per gallon in the plating bath—and from ten to twenty ounces in the strike solution. Cyanides are deliquescent and attract moisture from the atmosphere, as may be readily determined by placing a small amount of either potassium or sodium cyanide in a granulated form in a glass or porcelain vessel. In a few hours or perhaps a few days enough moisture is attracted to convert the entire mass into a liquid. This deliquescent property indicates that if there is an inclusion of cyanide it will attract moisture from the air, filling up the cavity and spreading over the surface.

Tests were made to determine the relative deliquescence of sodium and potassium cyanides. For this test the following samples were employed:

Sodium cyanide and potassium cyanide, indicated as chemically pure, and supplied as reagents for analytic laboratory work.

Sodium cyanide, commercial, having about 20 per cent. chlorides as purchased on the market.

So-called sodium cyanide equivalent in strength to highest test potassium cyanide and containing about 80 per cent. of sodium cyanide and 20 per cent. of sodium chloride, made up by the writers.

Two grams of each of these materials were placed on a watch glass and spread out so as to present approximately similar surfaces. At various periods up to 71 hours weight determinations were made, the results being given in Table No. 1. These results indicate that the samples of the c. p. and the commercial sodium cyanides were very similar in their behavior. In 71 hours the c. p. cyanide had taken up 195 per cent. of its weight of water, while the commercial had taken up 188. On the other hand, it is clearly indicated that the potassium cyanide takes up water only about one-half as rapidly as does the sodium salt. The mixed cyanide and chloride sample was not run at the same time as the others and perhaps the comparison is not entirely justified. If any conclusions may be drawn from the data here presented it would be that the mixed cyanide is approximately as deliquescent as is the higher strength sodium cyanide.

Table I.

DELIQUESCENT PROPERTIES OF MATERIALS AS PURCHASED.

Salt Used.	Weight Taken Grams.	Hours Standing.	Grains Water Absorbed.	Water in %of Salt.
NaCN C. P.	2.0	3	0.581	29
		7	1.085	54
		23	1.908	95
		71	3.899	195
KCN—C. P.	2.0	3	0.358	18
		7	0.603	30
		23	0.99	50
		71	1.956	98
NaCN—Commercial	2.0	3	.597	30
		7	1.081	54
		23	2.025	101
		71	3.76	188
NaCN—80%	2.088	19	1.889	95
NaCl—20%		67	3.426	164

Summary.

Hours Standing.	% of Water Absorbed by— NaCN C. P.	NaCN Commercial.	KCN C. P.	NaCN—80% NaCl—20%
3	29	30	18	...
7	54	54	30	...
19	...	...	...	95
25	95	101	50	...
67	...	...	...	164
71	195	188	98	...

On the supposition that the materials as used in the plating bath, after evaporating in the air, may not behave the same as do the materials as purchased, the sodium and potassium cyanides were first dissolved in water and then evaporated to dryness to a constant weight at a temperature of 100 degrees C. These samples were then exposed to the atmosphere and the rate at which water was absorbed was noted. The results are given in Table II, which indicates that while during the first three hours there was not a distinct difference between the sodium and potassium cyanides, at the end of 19 hours sodium cyanide had taken about twice as much water as had the potassium cyanide. At the end of 67 hours there was not as great a difference, although the potassium was still materially below the sodium cyanide.

It appears that while potassium cyanide was formerly used almost universally by platers, sodium cyanide has been very generally substituted for it during recent years. This has been brought about largely through the lower cost and greater availability of this material. Sodium cyanide can be manufactured with a much greater percentage of the cyanide radical than is possible with the potassium. This is due to a difference of atomic weight of sodium and potassium. In other words, while platers formerly expressed the strength of pure potassium cyanide as 100 per cent., the corresponding pure sodium cyanide would have a strength expressed as 133 per cent. To bring the strength of sodium cyanide so that it is equal to that of pure potassium cyanide, the presence of additional ingredients is possible, and it appears that a very common grade of cyanide now supplied to electroplaters

*A paper presented at the annual meeting of the American Institute of Metals, October 13-17, 1913, Chicago, Ill.

†Northern Chemical Engineering Laboratories, Madison, Wis.

contains about 80 per cent. of cyanide, and about 20 per cent. of chlorides, probably in the form of sodium chloride or salt.

TABLE II.

DELIQUESCENT PROPERTIES OF MATERIALS AFTER EVAPORATING AND DRYING AT 100 DEGREES C.

Salt Used.	Weight Taken Grams.	Hours Standing.	Grams Water Absorbed.	Water in % of Salt.
NaCN	1.4045	3	0.584	42
Commercial		19	1.794	128
		67	2.659	189
NaCN	2.0875	3	0.517	25
C. P.............		19	2.129	102
		67	4.048	196
KCN	2.0	3	0.557	30
C. P.............		19	1.123	56
		67	2.700	135

SUMMARY.

Hours Standing.	% Water Absorbed by NaCN Commercial.	NaCN C. P.	KCN C. P.
3	42	25	30
19	128	102	56
67	189	196	135

During the operation of the plating solution there is, especially in hot weather, a gradual decomposition of the free cyanide necessitating a continual addition of fresh cyanide to keep up the strength, and this results in a marked concentration of chlorides in the solution after it has been used for some time. If the grade of cyanide containing 20 per cent. of chloride is employed there will be a gradual increasing proportion of the inert chlorides. While the writers have no definite knowledge as to whether the presence of these chlorides is advantageous or otherwise from the standpoint of the operation of the bath, it is possible that they may have an influence upon the spotting-out problem.

Three plating solutions were tested by taking 10 c. c. from each and evaporating down to dryness at a temperature of 100 degrees C. The solutions Nos. 1 and 2 were made up from sodium cyanides containing 20 per cent. chloride. No. 1 had been in use with regular additions of silver and cyanide for about 10 months, and No. 2 had been in use about three months. A corresponding potassium cyanide plating solution which had recently been made up constituted solution No. 3.

On evaporating to dryness, solution No. 1 gave a residue of 2.793 grams; No. 2 solution gave 2.447 grams, while No. 3 solution gave a residue of .917 grams. The total material therefore which remains from the old solution was approximately three times as great as that from the potassium silver cyanide bath.

These various dried residues were then exposed to the atmosphere for 92 hours, periodical weight measurements being made. The results of these tests are given in Table III.

In a period of 92 hours the salt from solution No. 1 had taken up 3.541 grams, No. 2, 4.328 grams, and No. 3, 0.703 gram. In other words, the sodium cyanide residues took up from five to six times the amount of moisture that was taken up by the double potassium salt. Expressed in percentage of salt taken up per gram of residue, it appears that the double sodium salt with its content of sodium chloride takes up fully twice as large a percentage of moisture from the atmosphere as does the potassium double salt.

It may be suggested that the results in Table III indicate what might be expected from inclusions obtained from these three solutions. A cavity will, for example, take up a certain volume of liquid. On subjecting the articles to a drying process the amount of residues is proportional to the figures given in the second column of Table III. The amount of moisture which these residues will absorb from the atmosphere is proportional to the figures given in the fourth column of this table. This would indicate, then, that solution No. 1 is five times, and solution No. 2, six times as harmful as is solution No. 3.

TABLE III.

DELIQUESCENT PROPERTIES OF SALTS EVAPORATED FROM PLATING SOLUTIONS.

Solutions.	Weight Taken.	Hours Standing.	Water Absorbed Grams.	Water Absorbed in %.
No. 1......	2.793	21	1.772	63
		24	2.285	82
		28	2.549	91
		44	2.960	106
		92	3.541	127
No. 2......	2.447	21	2.166	80
		24	2.732	111
		28	3.091	126
		44	3.628	148
		92	4.328	177
No. 3......	.917	21	0.687	75
		24	0.805	88
		28	0.861	94
		44	0.756	83
		92	0.703	76

SUMMARY.

Hours Standing.	% Water Absorbed by Solutions. No. 1.	No. 2.	No. 3.
21	63	80	75
24	82	111	88
28	91	126	94
44	106	148	83
92	127	177	76

The writers distinctly recognize that these data are not absolutely quantitative or obtained under conditions insuring highest scientific accuracy. The rate at which moisture was absorbed from the air depends, of course, upon humidity conditions, and these conditions were not determined while the tests were made. In other words, if these same tests were made in the winter time the results might be materially different from those actually observed. Nevertheless, the data are significant in that they suggest a difference in properties as between potassium and sodium cyanides. The statements appearing frequently in the literature that sodium salts are less deliquescent than the potassium, and will for this reason cause less spotting-out, are evidently misleading.

There is no doubt that the spotting-out problem is of sufficient importance to warrant even more careful investigation than has thus far been devoted to it and a part of this investigation should include a study of the relative influence of the sodium and potassium cyandies. We cannot base a definite conclusion upon the mere fact that pure sodium cyanide attracts moisture more readily than does the similar potassium salt.

It is well known that during the operation of a plating bath the cyanides are gradually converted to carbonates. These carbonates may steadily accumulate in the bath, unless removed by the use of barium cyanide as a precipitating agent. Sodium carbonate is less deliquescent than is the potassium carbonate and we thus have a factor which may argue for the superiority of the sodium cyanide.

Another part of the investigation should include the

observation of the accumulated chlorides which occur when the sodium cyanide containing 20 per cent. of chlorides is used or when the bath is kept up to strength in silver by the continual addition of silver chloride. If there were no removal of solution by entrainment on the work the chlorides would increase indefinitely and the strength which a silver plating bath will attain depends upon the method of operating the tank and the nature of the work.

(THE END.)

ELECTRIC CLEANING OF METALS

A REPORT OF SOME EXPERIMENTS ON THE EFFECTS OF GASES ON METAL SURFACES.

BY WILLIAM VOSS.

The success of all kinds of electro-plating depends upon the work being chemically clean, that is, free from dirt, grease and oxides. This especially applies to work to be nickeled, as the chemical character of the nickel solution is such that it has no dissolving action on grease, being of a slightly acid condition while solutions that are in an alkaline condition tend to remove the grease and therefore make such deposits more successful. To get the work into a chemically clean condition, potash and various dips and scourings were, and perhaps still are, in use, depending upon the nature of the work to be cleaned. With the introduction of the electric cleaner as a cleaning agent some of the disadvantages of the old method of potashing and scouring were overcome. The advantage was mostly in favor of iron and steel as it was found that the non-ferrous metals were attacked by the cleaner, as at one time these cleaners consisting of potash, cyanide and ammonia were used hot. This cleaner was certainly a very disagreeable cleaner to operate, not only because of its action upon non-ferrous metals but to the fine sprays thrown from the surface of the cleaner when in operation, causing sores and poisoning to the operator.

One of the disadvantages of potash as a cleaner is its action upon non-ferrous metals in attacking and oxidizing them; therefore the cyanide dips and the addition of cyanide to the electric cleaner to remove or overcome this oxidation. The manufacturers of platers supplies began to realize the difficulties of the plating business and their efforts to help the plater to get his work into a chemically clear condition can be readily seen from the number of different salts for this purpose now on the market. The object was to get a salt that did not have the disadvantages of potash and could in most cases be used as an electric cleaner.

In this article I am treating upon the cleaning of non-ferrous metals and my experiments have been with such metals and their alloys. In the cleaning of metals and their alloys there are certain conditions that must be considered, such as the metals to be cleaned, the action of the various cleaning salts upon the work with and without the electric current, the strength of the cleaning solution, the kind of material to be removed and the pressure and current necessary to obtain the desired result without affecting the metallic surface and the finish thereupon. In the use of electric cleaners opinions differ as to which pole the article to be cleaned shall be connected. I know of a case where the manufacturers of the cleaning salts advised using the current in one direction and the plater found that the opposite gave him better results.

While the salts in the electric cleaner help to dissolve and remove the grease and foreign matter, the action of the current is a mechanical one, it depends upon the gas evolved to push off the non-metallic material as oil or grease. Since it is the gas evolved which helps to produce a clean surface it would appear that the work should be connected to the negative pole, as twice the amount of gas (hydrogen) is evolved at that pole, but this has a drawback when one considers the salts used, some of which attack the metal to be cleaned and therefore cause in time, as the cleaner is used, a slight undesirable film to be deposited upon the work as it is cleaned. To deposit metal upon such a surface is sure to meet with failure; therefore a reversed current, or the work hung on the positive pole, would appear best, but here we obtain but half the gas (oxygen), which requires the work to remain longer in the cleaner, also the base metals are more readily attacked, thereby destroying the finish upon the articles to be cleaned. Much depends upon the kind of material to be removed, for if the material be readily soluble in a weak alkali or softened in a warm solution, a great deal is gained, for there is less danger of attacking the metallic surface or finish. Flat work is easily cleaned, but castings full of relief work corners and holes make a difficult problem.

As the gaseous cleaning produced fairly good results, I decided to experiment along this line, with excellent results. I made use of both the hydrogen and oxygen gases and decided upon the alternating current at various pressures and currents up to 110 volts. The advantage of using alternating current was that I could get the hydrogen gas one instant and oxygen the next. This continuous alternation prevented the depositing or reduction of anything of a metallic nature, but proved very effective in removing non-metallic bodies, leaving the surfaces thoroughly clean and unaffected in regard to the finish. I found the results were better as the voltage was increased to a limit; the cleaning was very rapid and there was no apparent effect upon metallic alloys and metals. As I increased the pressure I was able to reduce the amount of cleaning salts, the latter acting as a conducting agent. The amount of gas evolved depends upon the amperage, and the voltage will break down the resisting material as grease and the like. The articles used for the experiments were full of holes, corner and like places, which make it difficult to extract the foreign matter, and they were thoroughly covered with such material as waxes, tripoli or composition, grease, varnish, fats, resins, shellacs and similar materials, and were allowed to cool and become thoroughly dry. They were then connected and put into a warm cleaner. In some cases the gases drove the material off the moment it touched the surface of the cleaning solution, while in others within a few minutes the article was free from the non-metallic particles or bodies. In withdrawing the work from the cleaner it is, of course, advisable to keep it connected until fully out of the solution, in that way preventing any foreign matter from again covering the surface of the articles.

ALUMINUM SAFE FOR COOKING.

Prof. John Glaister, of Glasgow University, tested aluminum cooking utensils to ascertain if food was in anyway injured by being prepared in them. The only substances that dissolved any of the metal were oranges, lemons, brussels sprouts and tomatoes, but even in these cases the quantity was so small as to be absolutely harmless.

THE DETERMINATION OF OXYGEN IN COPPER AND BRASS*

A Description of a Reliable Method for the Estimation of This Troublesome Element in Copper Alloys.

By T. West, M.Sc. (The University, Manchester.)

(Concluded from September.)

DETERMINATION OF OXYGEN IN COPPER, USING CARBON MONOXIDE AS REDUCING AGENT.

Murmann first used this gas for reducing oxidized copper. He heated copper in a current of carbon monoxide, and concluded that to completely reduce the metal it must be afterwards heated in a current of hydrogen. He calculated the oxygen by weighing the copper before and after reduction.

Lucas also determined the oxygen in copper by fusing a piece of copper, along with pure tin, in an electric furnace in a current of CO, and weighing the carbon dioxide formed. He stated that results agreeing with those determined by ignition in hydrogen were obtained.

A similar method to that of Lucas has been used in the present series of experiments. Pure carbon monoxide was prepared by heating a mixture of sodium formate and sulphuric acid and collecting the gas in an air-tight gasometer, whence the gas was passed through a series of purifying and drying tubes, as shown in Fig. 2. The carbon monoxide was passed successively through the following reagents: a solution of caustic potash and solid pieces of caustic potash to absorb carbon dioxide, a heated Jena glass tube containing copper gauze to remove oxygen by causing it to form carbon dioxide, a solution of caustic potash to absorb any carbon dioxide formed in the previous tube, strong sulphuric acid to dry the gas, another heated Jena glass tube to remove the last trace of oxygen, a tube containing solid potash, and a drying bottle of sulphuric acid. On leaving the last bottle the stream of gas was regulated by a tap, after which it passed through the actual combustion tube, and then along with any carbon dioxide formed through the absorption apparatus. The latter consists of bulbs containing dilute caustic potash combined with a tube filled with fine pieces of calcium chloride. A guard tube containing strong sulphuric acid was attached to the apparatus. As with the hydrogen apparatus, no rubber connections were used except where the absorption bulb was attached, and the various parts were either sealed together or joined by ground glass joints. The combustion tube was of glazed silica, and rested in the porcelain tube of an electric furnace fitted with water-cooled ends. The furnace temperature, which could be varied by a rheostat, was measured by a thermocouple, the wires of which passed between the porcelain and silica tubes and were connected to a pyrometer.

In all the experiments where carbon monoxide was the reducing agent, great importance was attached to the blank experiments which were carried out at frequent intervals. In such an experiment about 10 grammes of previously deoxidized copper were placed in the combustion tube, and when the absorption bulbs remained constant in weight while the gas passed at a fairly rapid rate (2 bubbles per second) for at least an hour the furnace was at once heated. The temperature was raised at 1050 degs. and held there for at least two hours, after which the absorption bulbs showed an increase in weight never exceeding 0.0002 gramme.

From 5 to 10 grammes of the copper drillings were inserted in the silica tube, the absorption bulbs and guard tube attached and the apparatus tested to see that it was quite air-tight. A steady current of gas was passed before heating the specimen, and when this current passing for an hour caused no increase in weight of the absorption bulbs the combustion was started. The furnace was then heated to a temperature of 900 degs. and held there for about two hours, while the gas was allowed to pass another half hour after ceasing to heat the furnace. The absorption apparatus was carefully disconnected and weighed full of carbon monoxide. To ensure complete reduction, the combustion may be carried on for a further hour.

In several experiments the conditions were varied somewhat. In some cases the temperature of combustion was raised to 1050 degs., and in others the copper was mixed with about one-fifth its weight of tin previously purified by melting in a stream of carbon monoxide; by heating to 900 degs. the two metals mix to form an alloy which is molten at this temperature. Concordant results were obtained under the various conditions. The following results may be compared with those on page 380.

	A. Per Cent.	B. Per Cent.	C. Per Cent.
Heating to 900°..........	0.079	0.172	.....
Heating to 1050°..........	0.081	0.173	.....
Heating with tin to 900°...	0.081	0.173	0.260

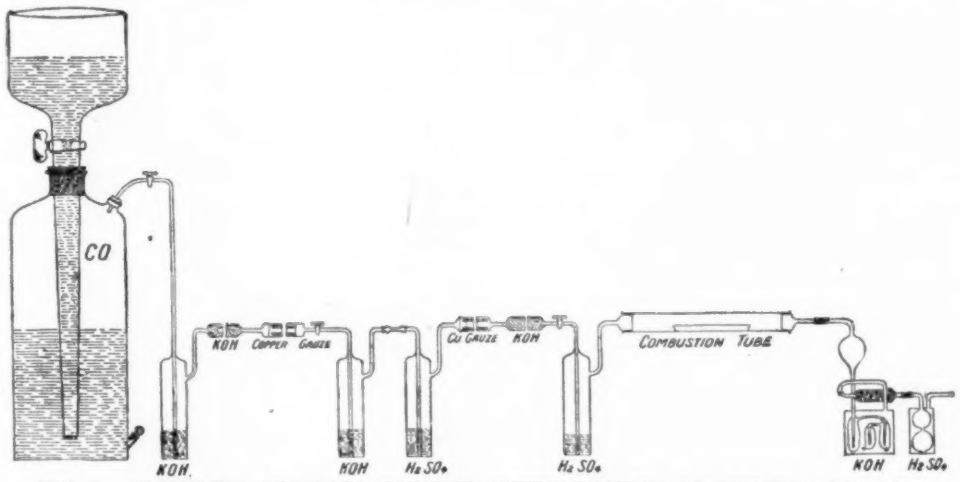


FIG. 2. APPARATUS REQUIRED FOR THE DETERMINATION OF OXYGEN IN BRASS.

*Paper read at Autumn meeting of Institute of Metals, Ghent, Belgium, August 28-29, 1913.

ACTION OF CARBON MONOXIDE ON BRASS.

As there is every likelihood of any oxygen in brass existing as zinc oxide, the behaviour of zinc oxide may be considered. Moissan has shown that zinc oxide is volatile in the electric furnace, but in an atmosphere of carbon monoxide and under the experimental conditions this effect was found to be negligible. A more important factor is the possibility of the reversibility of the equation

$$ZnO + CO = Zn + CO_2.$$

The experience of the zinc smelter proves that under certain conditions the reaction is a reversible one. When ores containing the zinc as carbonate are smelted, instead of obtaining a compact mass of metal, the final product contains in some cases a variable amount of bluish powder. This blue powder is formed owing to the reaction

$$Zn + CO_2 = ZnO + CO$$

occurring under the given conditions of temperature and pressure, and the minute particles of zinc oxide become entangled with the volatilized zinc and prevent coalescence. Bondonard, however, has shown that if the amount of carbon monoxide does not exceed a certain low percentage the reverse reaction does not occur and in such cases the zinc is obtained in a compact metallic form. A number of experiments were carried out under slightly varied conditions to determine how far the reduction of zinc oxide by carbon monoxide and weighing the resulting carbon dioxide could be relied upon as a qualitative test for zinc oxide. Different amounts of pure zinc oxide varying from 0.2 gramme to 0.02 gramme were weighed out into a porcelain boat which was introduced into the combustion tube, and a reduction carried out in a similar manner to the reduction of copper with carbon monoxide. With a slow current of gas flowing at the rate of one bubble per second, the amount of carbon dioxide formed corresponded to a much less weight of zinc oxide than was actually taken. When similar amounts of zinc oxide were taken but the rate of the current increased to three times the previous rate the amount of carbon dioxide formed corresponded to the actual weight of zinc oxide taken. The following are some typical results:

Rate of Flow of Gas.	Temperature.	Amount of Zinc Oxide actually taken. Gramme.	Amount of Zinc Oxide calculated from Carbon Monoxide formed. Gramme.
Slow	900°	0.2034	0.1512
do.	1050°	0.0209	0.0151
do.	1050°	0.1966	0.1645
Rapid	1050°	0.0219	0.0213
do	1050°	0.1922	0.1904
do.	1050°	0.1938	0.1923

On examining the tube after an experiment in which low results were obtained, it was observed that the zinc had condensed in the form of a bluish powder, while in the experiments in which a rapid flow of gas had been maintained the zinc adhered to the tube in the form of clear metallic globules.

Further experiments were carried out with mixtures of copper and zinc. The copper had been ignited previously and the oxygen percentage determined, while the zinc used was that obtained as globules in previous experiments. The two metals were weighed out into a porcelain boat in the proportion of 10 grammes of copper to 3 grammes of zinc, and introduced into the combustion tube of the apparatus. The temperature of the furnace was kept at 1050 degs. for two and a half hours, during which time a rapid current of carbon monoxide was passed. As the oxygen content of the copper was known, it was possible to calculate the amount of carbon dioxide compared with that obtained by experiment. The experimental and theoretical amounts of carbon dioxide were always in fair agreement; the former being slightly lower than the latter.

A number of tests were then carried out on samples of pure brass containing 60 to 70 per cent. of copper with negligible amounts of other metals. A piece of the alloy was taken, carefully filed, washed in alcohol, dried over quicklime, and introduced into the combustion pipe. The usual precautions were taken during the experiment; the carbon monoxide was passed in a rapid stream, and the furnace temperature quickly raised to 1050 degs. and held there for at least one and a half hours. The absorption bulbs were weighed with the necessary precautions and the combustion prolonged for a further hour, though this was found to be unnecessary, as the bulbs remained constant in weight. After several preliminary experiments, it was found desirable to use a weight of metal not less than 30 grammes, otherwise the increase in weight of the absorption bulbs was so small as to come within the experimental error of the method. The weights of the brasses taken varied from 30 to 80 grammes, and in most cases the amount of carbon dioxide formed never corresponded to much above 0.002 per cent. of oxygen, while in rare cases the amount was negligible. The figures for a typical determination are given:

A. BLANK EXPERIMENT.

	Grammes.
Weight of absorption bulbs at commencement.......	=82.7732
Weight of absorption bulbs after one hour's running at 1000°	=82.7733
Weight of absorption bulbs after two hours' running at 1000°	=82.7732

B. EXPERIMENT WITH BRASS.

Weight of brass	=49.1030
Weight of absorption bulbs at commencement.......	=79.9707
Weight of absorption bulbs after passing steady current of gas without heating the furnace..........	=79.9707
Weight of absorption bulbs after heating for one and a half hours at 1050° in a rapid current of gas....	=79.9744
Weight of absorption bulbs after heating for a further hour under similar conditions................	=79.9746
Increase in weight of absorption tube...............	= 0.0039
Thus the weight of carbon dioxide formed...........	= 0.0039

This weight of carbon dioxide gives the percentage of oxygen as

$$\frac{0.0039 \times 4 \times 100}{11 \times 49 \times 1030} = 0.0028$$

This and similar results from other experiments prove that ordinary brasses of good quality contain on an average about 0.002 to 0.003 per cent. of oxygen, which is evenly distributed throughout the mass of metal, most probably in the form of very minute particles of oxide of zinc. When it is remembered that the specific gravity of metallic oxides is much less than that of the metal, it is easily understood that even this amount of oxygen in the form of oxide will occupy a greater bulk than is at first apparent. If any sample of brass gives, on reduction in carbon monoxide as previously described, a much higher figure than 0.003 per cent. of oxygen, then it is most probable that that particular portion contained an unusually large piece of zinc oxide or other oxide impurity which has become entangled during the casting. Further, the analysis of a specimen from one sample of brass may disclose a higher percentage of oxygen than another, and yet the latter may be found to corrode more rapidly than the former. This may be explained by the fact that the one will corrode more rapidly which contains the segregated pieces of oxides, as a greater difference in potential

will be set up and the rate of corrosion will be more intense.

Some further tests were carried out with condenser-tube brass containing about 2 per cent. of tin and German silver. In these cases, however, a rather surprising result was obtained, as a deposit of carbon was found adhering to the metallic surface after cooling down in an atmosphere of carbon monoxide. With the brasses this deposit was quite small, but the percentage of oxygen was on the average about 0.006 per cent. In the case of German silver, however, the deposit of carbon was quite a heavy one, and if the alloy were mixed with a small amount of tin the deposit was heavier still, while the oxygen percentage varied so much that it was evident there was decomposition of carbon monoxide occurring. Some zinc was melted alone in a current of carbon monoxide, as was also some tin, but in neither case did any decomposition of carbon occur. When, however, a mixture of tin and zinc was melted in the gas there was a decomposition of carbon.

It would appear therefore from these experiments that while the percentage of oxygen in condenser tube brass containing only copper and zinc can be determined satisfactorily by ignition under carefully defined conditions in carbon monoxide, this method cannot be applied to the case of copper-zinc alloys containing either tin or nickel owing to the decomposition of carbon monoxide which is thereby caused.

In conclusion, the author wishes to thank Professor Carpenter, at whose suggestion this work was carried out, and for his kindly interest and helpful advice tendered during the course of the work.

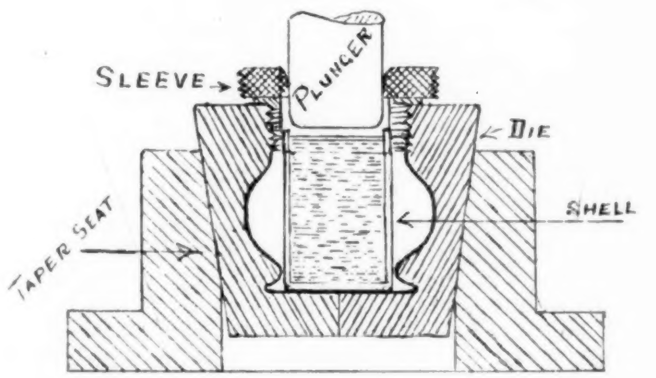
The research was carried out in the Metallurgical Laboratories of the University of Manchester.

HOLLOW PUNCHES AND FLUID DIES

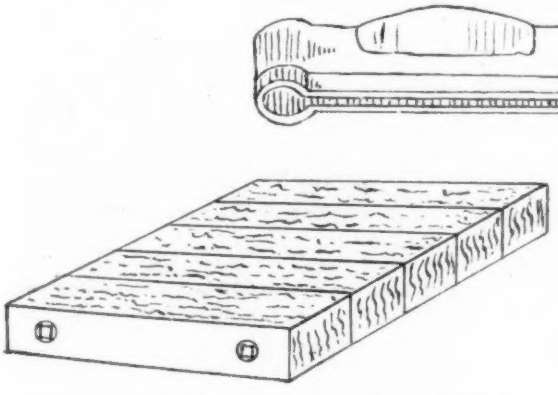
THE EIGHTH AND LAST OF A SERIES OF ARTICLES ON THE MANUFACTURE OF DIES. CONTINUED FROM JUNE.

BY EASY WAY.

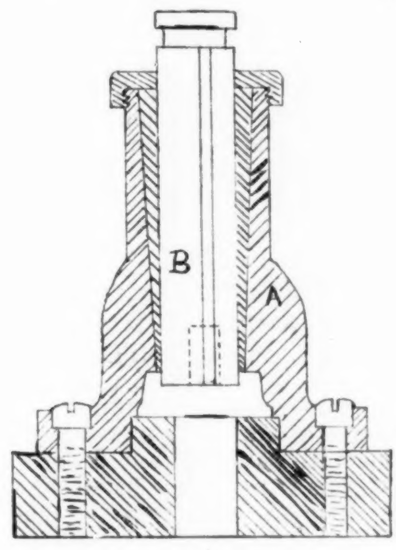
This type of cutter is used for producing articles from leather, cloth, paper and other spongy material and used mostly in boot and shoe factories, buffing wheel manufacturers and termed by them as hollow cutters or "dinking dies." This type of construction is cheaper to produce than the ordinary punch and die used for blanking and suits their requirements to a nicety. Because several thicknesses of material may be cut on a wood block at one blow where only one at a time is possible with the ordinary blanking die and in this way is far superior to it and cheaper to build. Dinking dies are formed cutters that may be used by hand, also in a foot or power press with a wood block underneath the material to be cut. This block is made up in sections so that the end of the grain forms the surface on which the cutter strikes and should be kept smooth and parallel. Also when not in use the block should be dampened slightly to prevent opening of the grain of the wood. The sketch shown is self-explanatory of the method employed for the speedy production of articles produced from leather, cloth, paper, etc.



FLUID DIE.



HOLLOW DIE AND CUTTING BOARD.



SUB PRESS FRAME.

FLUID DIES.

The fluid, forced, or mold type of dies are used for the production of various designs of hollow ware such as found in novelty work. The metals used are soft brass, silver, etc. The nature of these dies necessitates their construction to be built up in several parts as it is compulsory to open them when removing the piece from the forced out impression. The material generally used in their construction is soft close-grained iron and into this

the desired pattern is cut to produce the article required. The sketch shows the plan of one type fluid die and its general outside construction can be used for any shape wanted. By this way where many dies of this type are used the frame can be built and stored until the impression proper is required. Referring to the sketch it will be noted that the plunger, which is a sucking fit, works down through the knurled sleeve, thus causing the confined fluid with which the blank cup has been filled to force the metal into the impression in the die mold. Many times soft rubber or oil is used; this is merely a difference of opinion. But with them all, the plunger pressure and the substance used swells the metal to the die shape. In order to obtain every detail of the impression in the die, soft rubber, although more expensive, will produce the best results.

THE APPROXIMATE MELTING POINTS OF SOME COMMERCIAL COPPER ALLOYS *

By H. W. Gillett and A. B. Norton.

In the course of investigations of brass melting furnaces it was necessary to determine the approximate melting points of a few of the common brasses and bronzes. The binary systems of copper-tin and copper-zinc alloys have been thoroughly worked out not only as to melting points, but as to the full phase rule relationships, showing the different phases present in the solid alloys at different temperatures, and also as to tensile strength. The United States Alloys Research Board, under Thurston, studied the mechanical properties of the ternary systems of copper-zinc-tin alloys in detail, but as pyrometers were not perfected at the time of that investigation the temperature measurements were confined to very crude ones on the pouring temperatures of the two binary, copper-tin and copper-zinc systems, made by pouring the molten alloy into water, measuring the rise in temperature of the water and figuring the pouring temperature from the assumed specific heat of the alloy. The method, though the only one available at the time, was so crude and subject to so many errors that the figures are of little or no value. Experiments on the copper-zinc-tin system from the phase rule point of view are in progress at Cornell University, but no melting point determinations have yet been made.

Thus, while the melting points of the two binary systems are well known, those of the commercial casting alloys containing copper, zinc, tin and lead, or copper with two of the other components, have had little or no study.

LACK OF DATA ON THE MELTING POINTS OF TERNARY AND QUARTERNARY ALLOYS.

Very few figures on the melting points of ternary and quarternary alloys can be found in the literature on alloys.

Primrose[1] mentions pouring gun-metal consisting of 88 parts copper, 10 parts tin, and 2 parts zinc, at 950 C. (1740 F.)[2], this temperature being far too cold and giving a very poor casting of very low tensile strength, hence evidently not far above the melting point.

This figure is probably not correct, as an alloy consisting of 90 parts copper to 10 of tin has a melting point of about 1005 C. (1840 F.), and 2 parts of zinc would probably not lower the melting point to such a degree.

Primrose[3] in a later paper shows a cooling curve for gunmetal containing 88 per cent. of copper, 10 of tin and 2 of zinc, with less than 0.2 per cent. of lead (exact analysis not given), which shows the melting point (liquidus) at 1,010 C., or slightly above that for a corresponding zinc-free bronze, although some lowering of the melting point by the zinc might be expected.

Longmuir[4] also poured some alloys at a temperature at which the metal would just flow, and so cold that in all cases the castings were poor and the tensile strength very low. The results obtained by Longmuir were as follows:

POURING TEMPERATURES OF FOUR ALLOYS.

Alloys.	Degrees C.	Degrees F.
Gun metal	965	1,770
Yellow brass	850	1,560
Red brass	1,058	1,935
Muntz metal	943	1,730

These figures also are probably not accurate. The remark made on the earlier figure by Primrose for gun-metal applies here. The composition of the alloys was not given. If it be assumed that the names given have their normal significance the yellow brass would be about 65 parts copper and 35 parts zinc, an alloy which melts at about 915 C. (1,680 F.), and the Muntz metal would contain 60 parts copper and 40 parts zinc, an alloy which melts at about 890 C. (1,635 F.) Muntz metal has a lower melting point than yellow brass, not higher, as shown by these figures. Similarly, red brass of the common composition, which is about 85 parts copper, 5 tin, 5 zinc and 5 lead, has a lower melting point than gun-metal (taken as 88 parts of copper, 10 of tin and 2 of zinc).

Karr[5] used a radiation pyrometer in determining the melting points and pouring temperatures of some copper alloys. For an alloy of 68.8 parts copper, 0.2 of lead and 31 of zinc, he gives 1,640 F. (895 C.), which is considerably lower than the true melting point, evidently because of the well known deviation from black-body conditions of molten copper or its alloys. He gives 1,650 F. (900 C.) as the melting point of one alloy containing 84 per cent. copper, 1,735 F. (945 C.) for that of another of the same copper content, and 1,850 F. (1,010 C.) for another said to correspond to gun-metal, but containing no zinc.

Karr's figures are confessedly inaccurate because of the deviation from black-body conditions,, and in only one case is the exact composition of the alloy given.

Since the literature on the subject was found to be so meagre, it was decided to obtain figures on the melting points of a few typical commercial alloys with sufficient accuracy for the purpose in hand.

*A paper presented at the annual meeting of the American Institute of Metals, October 13-17, 1913, Chicago, Ill. Published by permission of the Director of the Bureau of Mines. This paper is also published by the Bureau of Mines as Technical Paper 60.

[1] Primrose, H. S., Metallography as an aid to the brass founder: Metal Ind., vol. 8, 1910, p. 466.

[2] Since the accuracy of temperature measurements at the melting points of brasses and bronzes do not warrant figuring to a degree, in transforming measurements taken in Centigrade or in Fahrenheit to the other scale, the results are calculated in round numbers to the nearest five or ten degrees.

[3] Primrose, H. S., and Primrose, J. S. G., Practical heat treatment of Admiralty gun-metal: Jour. Inst. Metals (British), vol. 9, 1913, p. 169.

[4] Longmuir, P., quoted by Law, E. F., Alloys and their industrial application, 1909, p. 10.

[5] Karr, C. P., The pouring and melting points of some high grade bronzes: Trans. Am. Brass Founders' Assn., vol. 5, 1911, p. 78.

METHODS USED IN THE TESTS.

The alloys were melted in a gas furnace. Instead of using the ordinary shape of crucible which exposes too large a surface to volatilization and oxidation, crucibles were made up from some bonded carborundum tubes which were in stock from a previous investigation.

The carborundum tubes which are described in detail by Gillett[6] were about 4.5 cm. inside diameter and had about 8 mm. walls. They were cut to about 15 cm. long, and an artificial graphite plug was fitted at one end to form the bottom, luting it into place with alundum cement. Considering the cost of machining out a crucible from a graphite rod, as well as that of the graphite itself, these were much cheaper than artificial graphite crucibles, especially as they do not burn away anywhere near as fast as graphite. Their life was as long as that of the ordinary crucibles of fire clay and graphite mixtures.

The temperatures were measured by a platinum, platinum-rhodium thermocouple used with a single pivot galvanometer.

The couple was calibrated against one which in turn had been checked against one calibrated by the Bureau of Standards, the secondary standard being read on a potentiometer, and the scale found to be correct within the limits of error of reading. The calibration was also checked up by reading the melting points of copper, of common salt and of a bronze of 90 parts copper and 10 parts tin. The scale was correct within the error of reading at these points.

As these calibrations were made with the cold junction at 20 C., the couple was used without placing the cold junction in ice water, the cold junction being so protected from the furnace that a thermometer at that point showed within 3 degrees of 20 degrees C. during all the runs.

The thermocouple wires were insulated by Marquardt tubing of 1 mm. bore and 2 mm. in outside diameter, and the hot junction was slipped into a Marquardt tube 30 cm. long and 9 mm. outside diameter and 5 mm. inside diameter closed at one end. The open end of this tube was fastened into an open ended porcelain tube 35 cm. long, 10 mm. inside diameter, 14 mm. outside diameter by alundum cement. This arrangement served to protect the couple from zinc fumes or reducing gases.

The end of the protecting tube was in turn protected from the molten metal by an artificial graphite boot, 9 cm. long and with 3 mm. walls.

There is a considerable time lag in the pyrometer reading when a cold protecting tube and boot is plunged into molten metal, but after the tube is once hot the lag is small. As the melting points were not determined by noting when the metal solidified, but by plotting temperatures against time, the proper temperatures for the heat evolution on freezing or heat absorption on melting should be shown even if there was some lag.

About 600 grams of metal was used in making the tests, the metals were weighed out in the proper proportions to form the alloy desired, a slight excess of zinc, increasing with the increasing zinc content, being allowed to compensate for volatilization. Electrolytic copper, Bertha zinc and chemically pure lead and tin were used. The copper was melted first, and covered with granular carbon and a little salt. When the copper was melted, the tin, the lead, and lastly the zinc was added, and the alloy well stirred with a graphite rod.

When the alloy was fully melted and mixed, the pyrometer was inserted and so clamped that the graphite boot did not touch the bottom or sides of the crucible. The gas flame was lowered and the temperature read every 15 seconds, stirring between each reading. When the alloy had frozen, the gas was turned up and a heating curve taken. This was repeated several timees. Zinc was continually volatilized from the melts containing zinc, but not in sufficient quantity to exert appreciable influence on the melting point, as duplicate runs agreed within 5 deg. C. in all cases. After the runs were completed, the melt was poured in most cases into an ingot mold, sampled and analyzed. As the analyses agreed well with the composition aimed at on the samples analyzed, the melts not containing zinc were not analyzed. Duplicate analyses of the same sample agreed within 0.1 per cent.

All the melts were made up from virgin metals except the sample of manganese bronze which was in the form of test-bar ends from a previous investigation.[7] It had tested 76,000 to 77,000 pounds per square inch tensile strength and 24 to 35 per cent. elongation in the standard brick-form test-bar. The bronze had

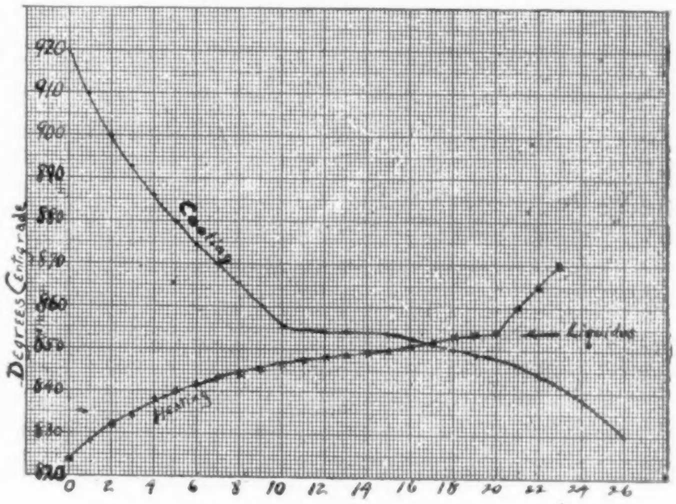


FIG. 1.—TYPICAL CURVES FOR ALL MELTING POINT DETERMINATIONS.

approximately the following composition: Copper, 56 per cent.; zinc, 41 per cent.; iron, 1.5 per cent.; tin, 0.9 per cent.; aluminum, 0.45 per cent.; and manganese, 0.15 per cent.

As it was first cast into an ingot, then remelted and cast into test bars and these again remelted for melting-point determination, the zinc content was probably nearer 40 than 41 per cent. and the copper nearer 57 than 56 per cent. when the melting points were taken. This sample was not analyzed.

The melting point given is the liquidus, or point where freezing begins on cooling and ends on heating. This is more strongly marked than the solidus, or point where freezing ends on cooling or begins on heating. Figure 1 shows one set of curves and the characteristic break at the melting point (liquidus).

These curves are typical of all melting point determinations.

[6] Gillett, H. W., Temperature Measurements in an experimental carborundum furnace: Jour. Phys. Chem., vol. 15, 1911, pp. 225, 227.

[7] Gillett, H. W., The influence of pouring temperature on manganese bronze: Trans. Am. Inst. Metals, vol. 6, 1912, p. 207.

RESULTS OF TESTS.

The data obtained in the determination of the melting points of several alloys were as follows:[8]

Although melting point determinations were made on only eleven alloys, those chosen represent a large proportion of the non-ferrous alloys in use in the ordinary foundry. Many of the other common alloys are near enough in composition to these or to the binary alloys, whose melting pints are given, to allow obtaining the melting point by interpolation close enough for most technical purposes.

RESULTS OF MELTING POINT DETERMINATIONS OF 10 ALLOYS

Alloy	Composition aimed at (Per Cent.)				Composition by Analysis (Per Cent.)				Number of duplicate determinations	Melting point (Liquidus)	
	Cu	Zn	Sn	Pb	Cu	Zn	Sn	Pb		C	F
Gun metal	88	2	10	..	...	...	...	..	4	995	1,825
Leaded gun metal	85½	2	9½	3	85.4	1.9	9.7	3.0	6	980	1,795
Red brass	85	5	5	5	...	...	(2 samples)		8	970	1,780
Low grade red brass	82	10	3	5	81.5	10.4	3.1	5.0	4	980	1,795
Leaded bronze	80	..	10	10	...	...	...	..	3	945	1,735
Bronze with zinc	85	5	10	..	84.6	5.0	10.4	..	4	980	1,795
Half yellow, half red	75	20	2	3	75.0	20.0	2.0	3.0	3	920	1,690
Cast yellow brass	67	31	..	2	66.9	30.8	...	2.3	4	895	1,645
Naval brass	61½	37	1½	..	61.7	36.9	1.4	..	5	855	1,570
Manganese bronze	..	..	..	..	...	...	...	..	6	870	1,600

As the results all checked within 5 C, an allowance of ± 10 C or ± 20 F is probably ample to cover all errors of reading and of calibration and use of the pyrometer.

MELTING POINTS OF BINARY METALS FROM THE LITERATURE ON ALLOYS.

For comparison the melting point (liquids) figures for binary systems of copper-tin,[9] copper-zinc,[10] and copper-lead[11] alloys for the range covering the common industrial alloys are given below. These are scaled off from curves in the references given. As the curves are small, the figures are only accurate to within about ± 10 C or ± 20 F.

MELTING POINTS OF 3 BINARY ALLOYS.

COPPER-TIN ALLOY.

Parts by Weight		Melting Point	
Copper	Tin	C	F
95	5	1,050	1,920
90	10	1,005	1,840
85	15	960	1,760
80	20	890	1,635

COPPER-ZINC ALLOY.

Copper	Zinc	C	F
95	5	1,070	1,960
90	10	1,055	1,930
85	15	1,025	1,880
80	20	1,000	1,830
75	25	980	1,795
70	30	940	1,725
65	35	915	1,660
60	40	890	1,635

COPPER-LEAD ALLOYS.

Copper	Lead	C	F
95	5	1,065	1,950
90	10	1,050	1,920
85	15	1,035	1,895

[8] The melting points and analyses in Table I were obtained by A. B. Norton, with aid from S. J. Popoff, at Cornell University, under the direction of Prof. W. D. Bancroft of Cornell University and H. W. Gillett of the Bureau of Mines, in the alloy work in which the Department of Chemistry at Cornell is co-operating with the bureau.

[9] Shepherd, E. S., and Upton, G. B., Tensile strength of copper-tin alloys: Jour. Phys. Chem., vol. 9, 1905, p. 446.

[10] Shepherd, E. S., The constitution of the copper-zinc alloys: Jour. Phys. Chem., vol. 8, 1904, p. 423.

[11] Desch, C. H., Metallography (Copper-lead alloys), 1910, p. 85.

DISCUSSION.

C. P. Karr: I wish to call your attention to some statements in Mr. Gillett's paper, which in part are misleading and in part erroneous. He quotes from my paper on "The pouring and melting points of some high grade bronzes," the following: "For an alloy of 68.8 parts of Cu. .02 of lead and 31 of zinc, that the melting point is 895 degs., which he alleges is considerably lower than the true melting point, evidently; he says because of the well known deviation from black body conditions of molten copper or its alloys," p. 5, and yet on page 9 for an alloy of 66.9 per cent. Cu. 30.8 per cent. Zn. and 2.3 per cent. Pb., he states the melting point to be also 895 degs. C. I contend that there is not enough difference in the chemical composition of the two alloys to lower the latter melting point 10 degs. C. below the former, or vice versa. He misquotes me in the next statement about an alloy said to contain 84 per cent. Cu. with a melting point of 900 deg. C. I never made such a statement. In reference to the statement of a copper alloy containing 84 per cent. corresponding to gun metal with a melting point of 1,010 deg. C., it happens to be the only specimen of which the melting point was taken with approximate black body conditions, i. e., with the aid of a crucible whose bottom was knocked out and inverted over the pot containing the metal, he states that the alloy contained no zinc. Did he analyze it? As a matter of fact it contained about 3 per cent. zinc, which practically agrees with the results obtained by Primrose, and is within 15 deg. of his own determination, his allowance for variation being ± 10 to ± 20 degs.

He further assumes Longmuir's figures are probably not accurate and apparently to discredit them he cites the lower values Longmuir obtained and states that some of the alloys were poured at a temperature at which the metal would just flow, and so cold that in *all cases* the castings were poor and the tensile strength very low. This is a rather sweeping statement, and part of it is inaccurate, because Longmuir poured some gun metal at a temperature of 1,069 degs. C., and achieved a result of 33,237 pounds per square inch in tensile strength, which is far from being low. In my paper the pouring temperature of the gun metal referred to was stated to be 1,075 degs. C., not very far away from Longmuir's results.

In my original paper no claim was made for exact accuracy

of the temperatures recorded, because they were made hurriedly under ordinary foundry conditions as a part of the day's work, in fact they were foundry, not laboratory tests. Mr. Gillett fails to supplement his records with any tensile tests to show what he accomplished, although condemning Mr. Longmuir's results. So far as I can learn there has been as yet no satisfactory relation established between the melting point and the correct pouring temperature of the usual commercial alloys, except as to the casting temperature of standard silver alloy. Mr. E. F. Law states in his work on alloys that at about 100 degs. C. above the initial freezing point of the alloy, such a difference would appear to be suitable for alloys melting in the neighborhood of 900 degs. C. Gillett's paper makes no reference to such an important practical relation.

In none of his tests has Mr. Gillett duplicated or made tests similar to those which I carried out, either as to conditions of time, or quantity of metal involved, or with foundry environment. Neither by analogy nor by experimental demonstration has he proved my figures to be "confessedly inaccurate" as he states. I submit this fact for your consideration, that while any one of course is open to criticism, for nobody is infallible, a conclusion based upon unverified premises falls to pieces of its own weight.

(Mr. Gillett's answer is not available at this time.—Ed.)

THE NOMENCLATURE OF NON-FERROUS ALLOYS*

SOME SUGGESTIONS FOR THE STANDARDIZING OF NAMES OF THE METALS AND ALLOYS IN EVERYDAY USE.

BY C. P. KARR.†

In his work on Metallic Alloys, Brannt states that there is such a confusion of terms that many whose interest it is to have an accurate knowledge of alloys do not know what bronze actually is. In corresponding with a large number of firms whose principle business is to produce and sell non-ferrous metals, there is a unanimity of opinion that this confusion of terms is increasing instead of diminishing, and some system of classification that at the same time is simple, scientific and flexible should be undertaken to make it universally acceptable. It is also believed that the various engineering and metallurgical societies will co-operate with the leading manufacturers and consumers to make its adoption general.

Bronze was originally understood to be an alloy formed wholly or chiefly of copper and tin in variable proportions. This enviable prominence and established tradition produced imitations that were far inferior in physical properties to the original alloys.

The etymological derivation of the term is in some doubt; by some authorities it is supposed to be derived from the same root as the word "brown," but according to Berthelot it is a place name, coming from *Als Brundisium*. A Green Ms. of the eleventh century contains the name *"Brontesion"* and gives the composition of the alloy as 1 lb. of copper to 2 oz. of tin. The bronze Gr. *Kalchos,* Latin *Als* of classical antiquity, consisted chiefly of copper alloyed with one or more metals, such as zinc, tin, lead and silver, in proportions that varied as times changed or according to the purpose for which the alloy was required.

The earliest authentic mention of bronze is made in the fourth chapter of Genesis, period of about 4,000 B.C. It is there designated as brass, but it is now believed by most authorities that it was an alloy of copper and tin, and not of copper and zinc, as zinc was then an unknown element, but by other authorities, that the word *brass* as used in the Old Testament referred to the element copper and not to one of its alloys.

Mr. Wm. Gowland states that the honor of making the earliest authenticated artistic bronze casting belongs to Egypt; that objects are in existence that were made as early as 3,000 B.C.

Bronze poniards, daggers and axes built of bronze and bone, hilts of ivory and horn are shown in the British Museum; also in Mr. Greenwell's collection at Durham, England, which were found in an Egyptian tomb of the date of 2,000 B.C. They contained about 88 parts of copper to 12 parts of tin. Bronzes are shown in European museums which bear the name of Thoutmo III, a king of the eighteenth Dynasty in Egypt; he lived during the first half of the seventeenth century B.C. The bronze age in Europe by most authorities is fixed at between 2000 to 1800 B.C., but some archeologists have denied that there ever was a distinct bronze age. The implements of the bronze age include swords, poniards, awls, knives, gouges, hammers, daggers, arrow heads and amulets. Drinking and cooking vessels were made of bronze in China in the Shang Dynasty, some 2000 B.C. Other bronze objects are known to have been made in China 1122 to 1249 B.C. In Homer mention is made of bronze articles; period of about or earlier than 850 B.C. bronze objects of various sorts were found by Layard at Ninevieh, which must have been made prior to 800 B.C. The five colossal bells at Pekin, China, were cast in the reign of the Emperor Yung Lo. A.D. 1403-24. Some authorities aver that the oldest bronze found in Germany dates from 1400 to 1500 B.C.; others claim that the earliest period is nearer 800 to 900 B.C.

Brass is an alloy consisting mainly if not exclusively of copper and zinc. In its earliest use the name was applied to alloys of copper and tin. The brass of the Bible was probably bronze. The Latin word *aes* was called either pure copper or bronze, not brass. The Romans designated an alloy of copper and zinc as orichalcum or aurichalcum, which Pliny states was made by a union of copper and cadmia (an ore of zinc).

The earliest specimen of a brass that has been noticed in England was found at Stoke Dabernon, Surrey, which consists of a memorial to Sir John d'Aubernoun, who died in 1277. In England there is evidence of the manufacture of brass at the close of the sixteenth century.

Fine copper is first mentioned in the Book of Ezra O.T. 457 B.C. Tin is first mentioned in the Bible in the first chapter of Isaiah, twenty-fifth verse, 750 B.C. Zinc was unknown in Europe until about the sixteenth century. The type of alloys which we know of to-day as composition was formed intentionally about 20 to 14 B.C. found in the coins of Augustus Cæsar.

The manufacture of brass in Germany was introduced in 1550 by Erasmus Ebener, an artist of Nurnberg, who prepared it by fusing copper with the so-called *tutia fornacem* or furnace cadmia. First made in England in 1781 by James Emerson according to one authority, but according to another it is stated that Queen Elizabeth granted a patent to William Humphrey to search and mine for calamine for making all sorts of battery wares, cast works and wire of latten in 1565.

Sheet copper was first made in America at Canton, Mass., in 1801 by Colonel Revere. The first founder who worked in brass in America was Joseph Jenks, who made

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brass and iron at Lynn, Mass., in 1646. In 1652 silver coins were cast in Massachusetts.

The first refined spelter was made at Bethlehem, Pa., in 1856. The manufacture of gilt buttons was begun in Connecticut by Abel Porter & Co. To obtain brass for this purpose the mixture was cast into ingots at Waterbury, Conn., where there was an iron mill, driven by water power, in 1802. The first rolling mill built in this country was established at Wolcottville, now Torrington, Conn., in 1834.

In 1808, Pittsburgh, Pa., contained a brass foundry, a bell maker, five watch and clock makers and a silversmith. Brass gun mountings were made in Philadelphia, Pa., by Lewis Prahle in 1776. Brass founding was carried on in Front street, near Market street, Philadelphia, Pa., by Joseph Hyatt in 1723. Among the tradesmen admitted to the freedom of the city of Philadelphia were James Everet and Simon Edgell, pewterers; Peter Steel and James Winstanly, braziers, in 1717 and 1718.

The first copper rolling mill established in America was built at Soho, N. J., by the Hendricks Brothers in 1814, and their mill is still in successful operation. The origin of many other well known alloys is involved in obscurity, especially as to the earliest date of their usage in the arts. It is claimed that Britannia metal was first made in England by Hancock and Jessop in 1770, and about the same time German silver was first made in Europe. Pakfong was introduced into Europe from China in the eighteenth century and was analyzed by Engstrom in 1776. A similar alloy was prepared about that time from Suhler white copper; the new silver fabrication, however, was begun in 1824 by Henniger in Berlin, and by Geitner in Schneeberg. German silver was originally made at Hildberghausen, Germany, and had a composition of 40.4 per cent. copper, 31.6 per cent. nickel, 25.4 per cent. zinc and 2.6 per cent. iron. But the date of its beginning is involved in uncertainty. It is known that pewter was made in China two thousand years ago. In France it was made as early as 1229, and in England some time prior to 1290. Pewton was made in America at a very early date, long anterior to the Revolutionary War. It is uncertain at just what date German silver was made in America, but it is believed by Mr. Sperry to have been begun sometime between 1850 and 1860 in the Naugatuck Valley, Connecticut. The Meneeley Bell Foundry was established at West Troy, N. Y., in 1826, but the first church bells were cast at Patuxet River, R. I., by Samuel Walds in 1735. Letters were addressed to a number of the principal manufacturers of non-ferrous alloys, in reference to their practice in naming their various alloys and as to their views concerning the relevancy of the various names used; there was a concensus of opinion that not only was then a confusion of names in vogue, but they also agreed that there was a confusion of ideas as to the correctness of these names as commonly applied but that it was now time that something should be done to simplify such names to promote a standard of practice. Many of the manufacturers make a great variety of alloys to which they attach numbers for shop identification, but which have no significance to the consumer. Many apply names of their own coinage which serve to connect them only with their own technical use. Many assign trade names which mean nothing to the consumer because their composition is unknown to him, but which facilitate the filling of orders. Some of them define bronze as a copper-tin alloy with or without lead because of a similar crystal formation in either case. One manufacturer suggested the terms *"leaded bronze"* and *"leaded brass"* to distinguish similar alloys that contain no lead. One manufacturer stated that the present nomenclature had grown up to its present state through years of use; he might have added also, through carelessness or abuse or both. Many names like "High Brass" and "Low Brass" have no meaning to the average foundryman, but are applied solely to rolled metals. Some admit that the strength of an alloy has some significance in determining the use of the term "bronze" — engineering practice. It is also alleged that engineers seem to prefer class names, such as "high brass" or "low brass," and to specify the composition of the same. Others agree that a bronze is a two-component alloy and includes the more complete mixtures in which the properties of the alloy are modified by the addition of other elements. One manufacturer states that there is no rational nomenclature in common use, some call a bronze any copper alloy that in strength, stiffness and color is comparable to the old bronzes used for bells, arms, statuary, etc., and that any alloy having copper as a base but which lacked the strength and stiffness of a true bronze would not be a bronze no matter what its constituents were.

To illustrate the confusion of ideas we cite the practice of one manufacturer, who claims that if an alloy has a light yellow color he would call it a brass no matter what its composition might be, thus an alloy of aluminum 10, copper 90, although of a light yellow color, he would call it a brass, or if it contained 76 per cent. copper, 13 per cent. tin and 1 per cent. aluminum, which is of a light yellow color, he would call it a brass, and yet this same manufacturer believes that a rational classification should be made. Another illustration may be cited from another letter of a manufacturer in which he states that a bronze is an alloy containing nine parts of copper to one part of zinc, and that in their foundry practice the alloys of copper and tin that contain less than 10 per cent. zinc carry the general designation of bronze.

One manufacturer states that bronze is supposed to be a mixture of copper, zinc and tin with a sufficient amount of lead for turning in machinery, and no matter in what proportion this is mixed, it is still termed a bronze, commonly known as low bronze, medium bronze and high bronze. The word "composition" is distinguished from this, in that the latter possesses no tin. Another manufacturer states that composition is an alloy of copper, tin and zinc, and may also contain other metals, usually lead.

All agree that in the art of metal founding there are now used a number of terms that are misnomers, some of which have so good a reason for the names they bear and have been so long estalibshed that it would be difficult to dislodge them from their present position. Among these misnomers may be placed such alloys as: nickel silver, argentan, white copper, weiss-keepfer, new-silver, silveroid, silverite, argirode and the general term German silver, which applies to all of the alloys of this class; they do not contain silver, although they have a silver-like lustre and color, and a more appropriate name would be a cupro-nickel alloy or composition. One manufacturer would call such an alloy a nickel brass.

Platinoid is an alloy possessing no platinum. It contains 60 per cent. copper, 14 per cent. nickel, 24 per cent. zinc and 2 per cent. tungsten and possesses some of the properties of a platinum alloy. It does not contain sufficient tungsten to affect its nomenclature. A cupro-nickel composition would be a better designation.

Manganese bronze is really a manganese brass, as it contains no tin and its characteristic properties are conferred by the addition of minute quantities of manganese in the process of melting. A better name for it would be a manganese brass composition. Several manufacturers are in accord with this designation.

Aluminum bronze is an alloy of copper and aluminum.

the latter metal may amount to as much as 11 per cent. and still be a serviceable alloy, but it contains no tin and is therefore not a true bronze; this much, however, may be said in extenuation of its name: Aluminum acts as a substitute for tin and imparts to the alloy properties similar to those produced by the presence of tin, also the term is established by long consistent usage. Furthermore, no confusion with the true bronzes is likely to arise because it is an alloy in which tin is seldom used and has distinctive properties of its own. There is some justification in the retention of the name.

Tobin bronze is an alloy of copper 55.22 per cent., zinc 39.48 per cent. and tin 2.30 per cent. (Thurston); this alloy is really a brass composition and a better name for it would be: Tobin-brass composition.

Fontaine-moreau's bronzes contain no tin whatever and are really white metal alloys. They vary from 91 to 99 per cent. zinc with 8 to 1 per cent. copper; one of them contains 90 per cent. zinc, 8 per cent. copper, 1 per cent. iron, 1 per cent. lead. The first might be called white metal alloys, the latter white metal composition.

Morin's imitation Chinese bronze contains 83 per cent. copper, 10 per cent. lead, 5 per cent. tin and 2 per cent. zinc. It is therefore a cupro-lead composition.

The so-called Japanese bronzes, analyzed by Kalischer (Dingler's Polyt. Jour., vol. CCXV., p. 93) contain copper 75.53 to 76.64 per cent., lead 11.88 to 12.2 per cent., zinc 6.53 to 6.58 per cent., tin 4.48 to 4.36 per cent., iron 0.47 to 0.33 per cent. and are practically cupro-lead compositions. Some Japanese bronzes analyzed by Maumené (Compt. rend., vol. lxxx, p. 1009) contain from 80.91 to 92.07 per cent. copper, 1.04 to 7.55 per cent. tin, 1.61 to 0 per cent. or antimony, 0 to 5.68 per cent. lead, 2.65 to 3.26 per cent. zinc, 0.69 to 3.64 per cent. iron, 0.4 to 0.10 per cent. silicon and 0.21 to 0.56 per cent. undetermined matter, all of the latter so-called Japanese bronzes but two might be called cupro-lead compositions, one of the two a bronze composition and the other one a cupro-ferrous composition. Not one of them is a true bronze. The so-called Chinese and art bronzes, called technically: Shakado and Shbichi are not in any sense bronzes. The first is a cupro-gold alloy, and the latter a cupro-silver alloy. Most of the Chinese and Japanese bronzes are cupro-lead compositions. Talmi gold contains 86.4 per cent copper. 12.2 per cent. zinc. It is merely a brass. Mosaic gold is another alloy of the same type. Birmingham platinum and platinum-lead are distinctly misfits as to names. They contain neither platinum nor lead, but have a variable constituency of copper, zinc and tin. Some of them contain no tin. Without tin they are brasses; with tin they become brass compositions, as the amount of tin employed is very small.

There are a number of alloys that are designated by special names, such as Delta, Monel, Speculum, Muntz, Pinchbeck, Tombac, Babbit, Type, Bell, Britannia, Pewter and the general family of solders are all names that offer no conflict with the bronzes, brasses and compositions and therefore serve their purpose. There are a number of trade-marked alloys which from the nature of their usage maintain practically a constant composition and do not conflict with the brasses nor bronzes. They simply increase the number of names but add no element of confusion to a rational system of nomenclature.

In order to arrive at a better understanding of the matter and to simplify the suggestions to be offered for a rational classification, it is necessary to furnish a few definitions which will explain the scope of the proposed tentative system of nomenclature.

Bronze may be defined as a two-component alloy consisting of copper and tin in variable proportions, but in which copper is the chief component with a suggested toleration of 1 per cent. of other metals.

Brass may be defined as a two-component alloy consisting of copper and zinc in variable proportions, but in which copper is the chief component with a suggested tolerance of 1 per cent. of other metals.

Composition is an alloy of copper with two or more other metals in variable proportions, but in which copper is the chief component. The chief minor constituent serving to give the titular and qualifying name to the composition. Where two of the metals are of equal percentage composition, the element which adds the most valuable property to the alloy will serve to give the combination its qualifying title. Thus an alloy of 76 per cent. copper, 12 per cent. tin and 12 per cent. zinc might be called a bronze composition, or an alloy of 80 per cent. copper, 10 per cent. lead and 10 per cent. aluminum might be called an aluminum composition. It is certainly neither a bronze nor a brass.

There are a number of terms which make a logical classification difficult because such names have acquired a certain permanency by reason of established usage, but almost all of them may be assigned to their places in the above tentative scheme, if we accept the suggestion offered by Dr. Rosenhain to the Institute of Metals of Great Britain in January, 1912. If we regard alloys fundamentally as binary alloys the matter of arrangement is simplified. To make his suggestion adaptable to a large field of alloys, it would be feasible to consider the two chief components of any alloy as the binary unit and consider the other components subservient to them as in reality they would be in the majority of possible combinations. The word cupro is distinctive and might be applied where most appropriate, especially where it may seem necessary to be more precise or definitive.

Even the much abused term "aluminum bronze" is a case in point, as used, of course, it is a misnomer, but there could be no confusion in calling any of the aluminum copper compounds, cupro aluminum alloys or compositions, it being understood in such a connection that the word "alloy" implies a binary compound, just as we refer to cupro-silicon, cupro-vanadium, cupro-titanium alloys and others. The same suggestion is offered for the binary metalloid combinations, such as phosphor copper, etc. Phosphor bronze is a term that is an exception to the proposed classification, in this case the minor constituent dominates and establishes the name. A conventional system of numbering if universally adopted would be highly advantageous to both consumer and maker, especially in the phosphorous and silicon compounds.

In the so-called white metals we have a term that is almost generic in its application and may be made general by bearing in mind certain fundamental distinctions. If we define a white metal alloy as a binary alloy of white metals which are the chief components, to which other metals may be added in variable proportions, we shall produce an alloy whose dominating color is white or nearly so, a distinctive property, we may embrace in such a classification almost every known white metal alloy or combination excepting the cupro-nickel alloys, but by our definition they would be excluded because the two chief components of the nickel silver compositions are not white metals. Generally speaking a white metal alloy would be a binary combination of two white metals, a white metal composition would be a combination in which tin, zinc aluminum, lead or antimony or any two of them is the chief component when three or more elements are united together. In the class of white metal alloys and compositions there may be further subdivisions which are

otherwise recognized as Britannia metal, pewters, fusible metals, solders and amalgams.

Britannia metal is an alloy chiefly of tin and antimony with some lead and sometimes minor additions of other metals. Pewter is chiefly an alloy of tin and lead with sometimes added small quantities of other metals. Fusible metals are distinguished from other white metals by their own chief characteristic, viz.: fusibility. Soft solders are alloys of tin, lead and other metals. Hard solders are not necessarily white metals, and as a rule take the suffix of the alloy to which they are applied, such as brass solder, aluminum solder, etc. The noble metals follow the same binary arrangement, any two of the noble metals alloyed together would be called alloys, any three would place them in the composition class according to their chief minor component. The trade-marked alloys might be maintained as they are now used, provided the names of brass or bronze were not tacked on to them for such a procedure would furnish a misleading designation. Special names might be preserved, such as Delta Metal, Muntz Metal, Pinchbeck, etc., so long as no other distinctive metal term is subjoined to give them a spurious significance. Amalgams form a class by themselves and are known to be liquid alloys or plastic combinations of one or more metals with mercury. It would simplify the meaning of such terms if the metal combined with the mercury were to be named first, such as sodium amalgum, etc., in order to give the consumer a distinct understanding of what he is using.

The tentative scheme of classification suggested may be summarized as follows:

Bronze.—A copper-tin binary alloy with copper as the chief component.

Brass.—A copper-zinc binary alloy with copper as the chief component.

Composition.—An alloy of two or more metals with copper as the chief component.

Sub-divisions:
- Bronze Composition.—A binary alloy of copper and tin with one or more other variable components, but in which tin is the chief minor component, or furnishes the compound with its most important physical property.
- Brass Composition.—A binary alloy of copper and zinc combined with one or more other variable components, but in which zinc is the chief minor component.
- Lead composition, and aluminum and other compositions follow the same general suggestion.

White Metal Alloys.—A binary combination of any two white metals.

White Metal Composition.—A binary alloy of two white metals, combined with one or more other variable minor components, such as Britannia, pewters, fusible metals and soft solders.

Antifriction and Bearing Metals. — May be divided into two or three classes, according to their composition. The white bearing or antifriction metals are all either white metal alloys or compositions, all others are either brasses or bronzes, or their corresponding compositions.

Noble Metal Alloys—Binary combinations of the noble metals.

Noble Metal Compositions—Binary alloys of the noble metals in combination with one or more other noble or base metals as minor components.

Amalgams—Alloys of mercury with various metals.

Special Alloys—Alloys known by distinctive names, yet by their composition may be placed in one of the above groups.

Trade Names—Alloys whose names are trade marked, yet may be classified in one of the above groups if their composition be known.

Binary Alloys.—Exclusive of bronze and brass may be placed in a class by themselves, the chief constituents forming the qualifying title, such as cupro-vanadium, cupro-tungsten, etc.

Miscellaneous and Misnomers.—All of the so-called nickel-silver alloys may be classified as cupro-nickel alloys or compositions according to the number of constituents they possess.

A few examples may be cited to illustrate the application of the above tentative classification with some agreements and conflict with present day practice.

Gun bronze, or 90 per cent. copper and 10 per cent. tin is a true bronze.

Government metal, or 88 per cent. copper, 10 per cent. tin and 2 per cent. zinc, is a bronze composition.

Muntz metal, or 60 per cent. copper and 40 per cent. zinc, is a true brass, known in the trade as a yellow brass.

Red metal, or 70 per cent. copper, 20 per cent. zinc, 6 per cent. lead and 4 per cent. tin, is a brass composition.

Bell metal, or 80 per cent. copper and 20 per cent. tin, is a true bronze.

Arsenic bronze, or 89.20 to 82.20 per cent. copper, 10 per cent. tin and 7 per cent. lead, with traces or perceptible increments of arsenic, is a bearing metal and might be classed as a bronze composition.

Plastic bronze, or copper 69 per cent., tin 10 per cent., lead 21 per cent., is a bearing metal and might be called a lead composition.

Commercial rod-brass, or 60 to 63 per cent. copper, not more than 3 per cent. lead and the balance zinc, might be called a brass composition.

Monel metal, or 67 per cent. nickel, 27 per cent. copper and 6 per cent. of other metals, although known to the trade by no other name, might be called a nickel-copper composition.

Naval brass, or 59 to 63 per cent. copper, 0.5 to 1.5 per cent. tin, .02 to 1 per cent. lead, .06 per cent. iron, balance zinc, may be called a brass composition.

Bismuth bronze is a peculiar alloy, it contains 69 per cent. copper, 21 per cent. zinc, 9 parts of nickel and one part of bismuth alloyed with some tin. It might be considered a low grade of German silver. It is practically a nickel hardened brass made to melt at a low temperature. It might be called a cupro-nickel composition.

Mannheim gold is a misnomer. It has practically the same composition as Tombac and Prince's metal, containing 89.44 per cent. copper and 9.14 per cent. zinc according to one authority, while another states it is 75 per cent. copper to 25 per cent. zinc or 80 per cent. copper to 20 per cent. zinc, but all agree that it is strictly a true brass and nothing more.

Manganese bronze, so-called, is composed of 57 to 60 per cent. copper, 0.5 per cent. tin, 37 to 40 per cent. zinc. Iron to not exceed 1 per cent. and 0.3 per cent. manganese and sometimes contains aluminum. It is plainly to be seen that this combination is a manganese brass composition.

Phosphor bronze is an alloy of copper and tin with generally less than one per cent. of phosphorous. There is no serious objection to this name.

Aluminum bronze is an alloy of copper and aluminum in variable proportions, while it has many admirable properties, it is begging the question to call it a bronze. If the trade could accept conventional numbers for the 5 and 10 per cent. aluminum constituent as Nos. 1 and 2 respectively, it might soon become known to all consumers as No. 1 and No. 2 cupro-aluminum alloys respectively.

Many alloys bear distinctive names, but their classification offers no difficulties nor conflicts.

Onion's alloy is a fusible metal, composed of lead 3 parts, tin 2 parts and bismuth 5 parts. It melts at 197 degs. Fahr.

Queen's metal contains 76 per cent. tin, 8 per cent. bismuth, 8 per cent. lead. It is a pewter, otherwise a white metal composition.

Mackensie's alloy contains antimony 16 per cent., bismuth 16 per cent., lead 68 per cent. or antimony 17 per cent., tin 13 per cent., lead 70 per cent. It is a good stereotype metal, otherwise a white metal composition.

Kingston's metal contains 9 part copper to 24 parts tin, remelted and added to 108 parts tin, 9 parts of mercury and is a white metal composition.

Platine is composed of 43 per cent. copper and 57 per cent. zinc and is a white metal alloy. Many other special names might be added to the list, but all of them are capable of classification as suggested.

THE OVERHAULING OF METAL

A Brief Description of the Progress Made in Scraping Metal Surfaces.

By L. J. Krom.

The process of scraping the surface of a bar of brass that has been cast in an iron mold and is intended for rolling into sheet or drawing into wire has long been known under the name of "overhauling." This "overhauling" is necessary in order to get rid of imperfections in the surface of the bar or rod in the shape of pits, scales, cold shots, fins, imbedded dirt, such as particles of charcoal or slag, or any other blemishes that would prevent the working of perfect metal. In the olden days of brass making, the brass bars for sheet and ingots or bolts for wire were hand "overhauled." A flat end scraping tool was used for bars and a rough file for the rod bolts. In fact, it was only a few weeks ago that we noticed files being used in a modern brass mill.

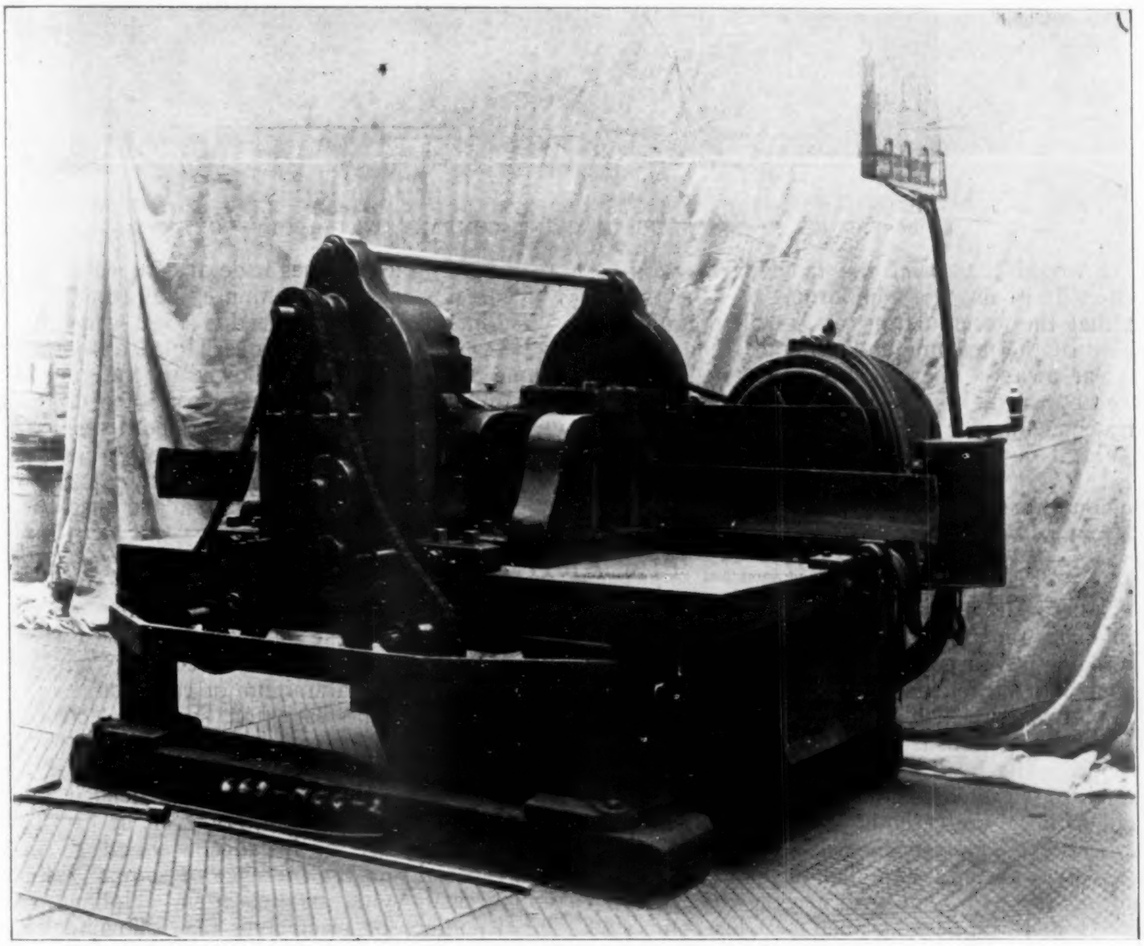

FIG. 1.—THE CHATFIELD ROTARY OVERHAULER.

The first attempts at machines for overhauling were rather crude, and I would like to be able to show a picture or two of them, but they are not available.

Of the modern machines, that shown in Fig. 2 perhaps represents the most successful type, and is in use in most all brass mills.

These machines represent the latest development of the celebrated Stever scraping machine, which was the first successful machine to supplant the slow and expensive process of scraping brass bars by hand. The early machines were crudely built and were of light construction and were not intended to operate at high speeds. They, however, marked a great advance over the hand process. The machines built on the Stever type have been gradually improved, and those now offered are as much in advance of machines previously built as the old Stever machine was over the hand process; they are refined in design, workmanship and materials and cover thoroughly the ground demanded by modern methods of production. These machines permit of operating the cutting tool at a high speed and are strongly constructed, so that the large chips are rapidly removed. The use of the modern high-speed steels has been one of the important

factors in forcing the design of a suitable high-speed machine; these high-speed steels allowing of much greater cutting speed without undue wear than the older types of steel. A very important feature in connection with the rapid scraping of the brass surfaces is to have the machine very convenient and with the tables arranged so that they can be easily shifted and properly proportioned so that an operator can work at scraping all day without appreciably reducing his production toward the end of the day, as would happen if the table parts were too cumbersome. It is also very important to have the design such that the accumulating chips will not obstruct the operation of the machine and demand frequent stoppages to clear away. These points have all been carefully worked out in these machines.

The latest machine for the "overhauling" of metals is shown in Fig. 1, and is called a "Rotary Overhauling Machine."

This machine was designed by James M. Chatfield and Karl W. Hallden of Thomaston, Conn., and is adapted for removing the oxide surface of metals such as brass, copper, German silver, zinc, etc. The bars of metal to be overhauled may be from 10½ inches width down and ⅜ inch thick up to 2½ inches thick. The machine is operated by two men and is handled a good deal like a wood planer, except that the metal is passed along on its edge instead of laying down flat.

There are three different speeds of the feed rolls. The bars up to 8 inches wide are passed along at the rate of 6 feet 4 inches per minute, and from 8 inches up to 10½ inches, the rate of feed is 4 feet 4 inches per minute. These bars of metal are overhauled on both sides at the same time and may be followed up the same as in a rolling mill. It is evident that bars 5 feet long, any width up to 8 inches are overhauled on both sides at the rate of 75 bars an hour, or 400 square feet of surface per hour.

It may be seen that the capacity of this machine is about ten times that of the standard machine.

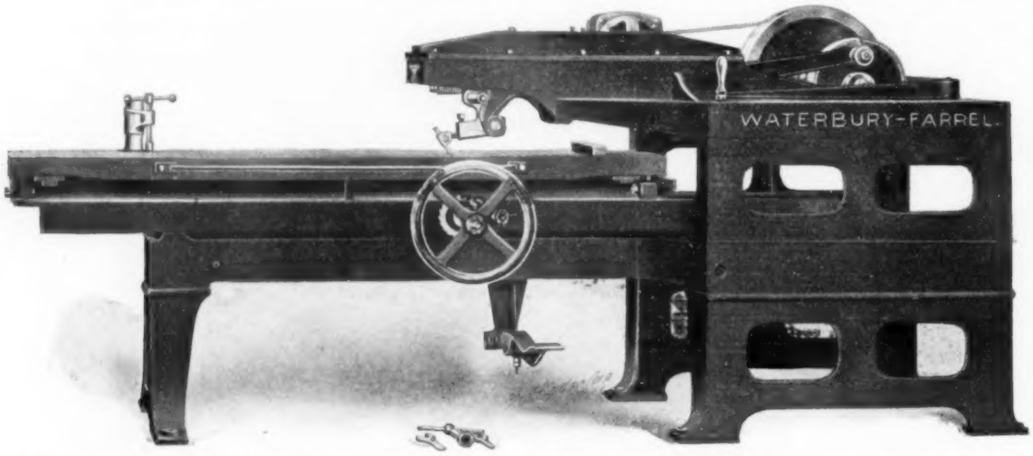

FIG. 2.—SCRATCHING MACHINE OF THE STEVER TYPE, MOTOR DRIVEN. MADE BY THE WATERBURY FARREL FOUNDRY AND MACHINE COMPANY, WATERBURY, CONN.

NICKEL, TIN AND ZINC BATHS

In the "Bulletin de la Société de l'Encouragement" A. Holland publishes several interesting practical hints as to the manner of preventing nonsuccess with baths for electroplating with nickel, tin and zinc.

In electroplating with nickel, the reason for the formation of a bad coating is usually that hydrogen is set free at the cathode. The best way to get around this is to compel the hydrogen to enter at once into a chemical combination and so leave the cathode clean. One suggestion in this connection is to introduce oxygen, and so burn the hydrogen away at once. Another seems to give better results; uniting the hydrogen with a somewhat complex compound. Holland suggests as such complex compound boracic acid dissolved in hydrofluoric acid (HFL). In this hydrofluoric acid, which is an acid like muriatic acid, the nickel carbonate dissolves to saturation. It should be noted that the nickel carbonate of trade does not sufficiently neutralize the acid, so it should be made fresh for the purpose. To two liters of the electrolyte there are necessary the following quantities: 350 grams of sodium carbonate and 600 of nickel sulphate; 130 grams of boric acid are dissolved in 285 of the acid solution above mentioned, and after repeated washing and filtering, diluted with water to two liters of electrolytic liquid. The anode must be of pure nickel, and have equal surface with the cathode. Before the bath is used it must be subjected to the action of the electric current for several days. The necessary current for a distance of 4 cm. between the electrodes, and surfaces of these latter 145 by 180 mm., is one ampere. The bath thus prepared is suitable for depositing the thinnest nickel coatings, and will deposit nickel directly on aluminum or cast iron.

As regards the bath for tinning electrolytically, the same trouble is also to be awaited—that hydrogen will be liberated at the cathode. As a result, if the current strength is economically chosen, the deposit will be porous and spongy. The tin will, however, be firm if an oxidizing medium (as, for instance, stannate of tin) is used, and especially in the presence of sodium sulphate, which unites easily with the hydrogen. Holland recommends for 1.7 liters of electrolyte the following quantities of ingredients: In 125 grams of stannate of tin of 15 Baumé 200 grams per liter of sodium sulphate are dissolved, heated to 80 degs. C. and used between an iron ode and the articles to be tinned as cathode. With a current strength of 0.2 amperes per 100 square centimeters of cathode, 1.1 grams of tin per ampere can be deposited.

With zinc baths it is essential to acidulate the bath constantly. The best is a solution of an organic acid in the presence of ammonium acetate. The zinc sulphate of the electrolyte gives off, besides the zinc deposit, sulphuric acid, which unites with the ammonium acetate to form ammonium sulphate and acetic acid. The following quantities are recommended: 500 grams of ammonium sulphate, 100 of ammonium acetate, 25 of citric acid; the whole diluted to two liters at a temperature of 50 degs. C.

THE SILVERING OF MIRRORS

A Detailed Description of the Process with Some Instruction for Its Successful Operation.

By Emmanuel Blassett, Jr.

There are very few job plating shops that do resilvering of mirrors, and electroplaters who are not familiar with this process may find this article a useful guide. No attempt is made here to describe the process employed by manufacturers of mirrors, whose methods may vary considerably from those given by the writer. Any job plater should be able, after a little practice, to do a satisfactory job on resilvering mirrors, and the apparatus employed is simple and inexpensive. The job plater who is located in the smaller cities may do a considerable business in resilvering mirrors, and job platers in general will find it profitable to handle mirrors in connection with their regular line of metal work.

The silver on mirrors is apt to be affected by variations in temperature causing it to contract or expand, and when this happens the silver falls off in small flakes. If the backing of paint that protects the silver should become loose, it may also be affected by the light. It is in nearly all cases far cheaper to resilver the mirror than to purchase a new one.

EQUIPMENT AND APPARATUS.

The following is a list of the apparatus necessary for resilvering mirrors:

4 Glass bottles (1 gallon each).
1 Glass stirring rod.
Scales.
Filter paper.
1 Graduate (1 quart).
1 China pitcher (2 quarts).
1 Enamel or agate ware kettle (1 gallon).
Gas stove.

The most important requirement for resilvering mirrors is a proper room in which the process is carried out. A room 8 by 12 feet or so in size will be found sufficiently large enough for ordinary work. It should be kept dustproof as much as possible by covering wood partitions with thick cloth or canvas. All windows should be calked up and never opened. The temperature of the room while silvering mirrors should be about 100 degs. F., and it may be heated by a steam coil, or wood stove. No gas should be burned in the room, as some of the uncombustible matter may settle on the glass. A large table is placed in the center of the room on which the silvering is done. It is best to cover the table with sheet iron, coated with an acid-proof paint. The edge of the sheet iron should be bent to form a narrow trough or gutter around the table. The gutter should be slanted to one end where all liquids are allowed to run through a small hole into a vessel placed on the floor. The surface of the table should be as level as possible.

PREPARING THE GLASS FOR RESILVERING.

The first operation in resilvering is to remove the backing of paint that protects the silver. This is accomplished by laying the mirror on several small blocks of wood placed on the table in the resilvering room. A paper should be placed under the mirror on which the paint is collected on being removed. A good paint remover is applied and allowed to soak into the paint for a short time. It is then scraped off with a piece of card board on to the paper. The paint and paper should be saved, as it contains some silver. The next operation is to remove the silver. A mixture of nitric acid and water (6 parts acid to 1 of water) is used for this purpose. After removing the silver the glass is rinsed off with ordinary water. Before the silvering solution is applied the glass is carefully polished with fine silver rouge and a few drops of liquid ammonia; all the rouge should be thoroughly wiped off by successively using several pieces of linen cloth. The cloth may be placed around a piece of felt or a smooth block of wood.

The mirror is now ready for resilvering. It is laid on several wedges of wood placed on the table in the silvering room, and made perfectly level. As previously stated, the temperature of the room should be about 100 degs. F. To ascertain if the glass is level, hot water is poured upon its surface. When the glass is perfectly level, the water will not flow off, and in that position it will retain the silvering solution.

SOLUTION FOR SILVERING.

In making up the solutions for silvering only rain or distilled water must be used. If rain water is used it should be carefully filtered. Solution No. 1 is made as follows:

Water	2 quarts.
Silver nitrate	13 dwt.

When the silver is thoroughly dissolved add slowly liquid ammonia of 26 degs. until the solution turns perceptibly brown. When this point is reached, continue adding the ammonia drop by drop until the white color of the solution is restored. Great caution must be used in not adding too much ammonia, as the color changes rapidly. A separate solution of

Water	2 quarts.
Silver nitrate	11 dwt.

is now made up and the two solutions mixed together. The whole is then allowed to stand for about 12 hours, when it is carefully filtered. This solution should be kept in a large bottle and labeled Solution No. 1.

Solution No. 2 is made up as follows:

Water	1 gallon.
Silver nitrate	8 dwt.
Rochelle salts	8 dwt.

This solution should be boiled for several minutes. Like solution No. 1 it should be allowed to stand about 12 hours and then carefully filtered.

SILVERING THE GLASS.

Four ounces of solution to every square foot of glass is required. Equal portions of solutions Nos. 1 and 2 are carefully measured out in the graduate and mixed. The solution may be poured upon the glass by using a large china pitcher. After the two solutions are mixed they should be immediately applied to the glass. If they are allowed to stand for any length of time, good results cannot be produced. As previously stated, the glass is made perfectly level by using small wooden wedges and pouring hot water upon its surface. When it is perfectly level it will retain the water on its surface, this being due to capillary attraction. The glass should be left covered with hot water until the silvering solution is applied. Before pouring on the silvering solution the water is allowed to drain off by gently tipping up the glass. The glass should be carefully laid back in the same position and the silvering solution immediately poured on. The silvering solution is allowed to remain on the

glass for 30 minutes or longer, if desired. The residue is then poured off and the silvered surface of the glass is washed off with ordinary cold water. The glass is now allowed to dry thoroughly and the silvered surface is then coated over with a suitable paint. The writer uses a paint made up as follows:

Turpentine asphaltum	1 quart.
Damar varnish	4 ounces.
White lead	2 "
Turpentine	3 "

The white lead is dissolved in the turpentine, and all the ingredients are thoroughly mixed together. The paint should be applied carefully with a soft brush, preferably a camel's hair brush. When the paint is sufficiently dry, the face of the mirror is examined and all silver or paint that may have adhered to it is removed and the glass polished with a little rouge and a few drops of liquid ammonia, using a cloth. The mirror is then ready for framing.

Occasionally the jobber is called upon to resilver mirrors that are made with mercury. It is not advisable to remove the mercury with an acid, as the heat generated will often crack the glass, on account of the large amount of mercury being present. It may be scraped off with a thin piece of wood. Mercury has been used extensively in the past in making mirrors, but it is not now employed for this purpose. Some attempts have been made to use aluminum, on account of its cheapness, but the results are not as satisfactory as when silver is employed.

CORROSION OF COPPER

A Report of an Investigation Into the Relation of Hard and Soft Spots in Copper and Their Effects.

By Thomas A. Eastick.

It has come to be a pretty well settled fact among chemists and metallurgists that the excessive corrosion of metals and alloys is due to electrolytic action. If corrosion be due to electrolytic action, one naturally asks where the necessary current comes from, and so far as we can see, there are two sources:

1. The metal conducts electricity, accidentally, perhaps, as in acting as a ground for currents used for lighting or power.
2. The current is generated at the surface of the metal itself by the formation of electrolytic cells.

In the former case, corrosion is evidently unavoidable so long as stray currents exist, for right here it may be remarked that where an electric current leaves the metal it forms a pole at which very active chemical agents are evolved, in the case of sea water, and that no metal or alloy will stand up to them. The second case, that of corrosion due to local galvanic action, seems to be more readily remedied, and it concerns the metal itself rather than the condition of use. Local galvanic action has been assumed to be due to the presence of impurities in the metal, with which it forms an electrolytic cell, but in the case of copper sheathing and tubes this hardly applies, since commercial copper nowadays is remarkably pure and uniform in composition, more so, perhaps, than any other metal.

Professor C. F. Burgess made some experiments on the corrosion of iron (Trans. Am. Elect. Soc., Vol. 13), in which he found that strained iron and steel corroded faster than unstrained, and that this was due to the formation of electrolytic cells in which the strained metal was one pole and the unstrained the other. It occurred to the writer, therefore, to examine copper in this respect. The copper used was ordinary sheet copper which analysed 99.85 per cent. Cu., and the hardnesses were taken with the scleroscope, using the "magnifice hammer."

Experiment 1.

Two pieces of copper were weighed and immersed in a 10 per cent. salt solution for 56 hours at 50 degs. They were connected to one another by a copper wire running outside of the solution, similar to an ordinary simple cell. Their hardnesses were 44 and 12, respectively. The relative rates of corrosion in this experiment were as 3 to 2. The hard metal corroding the faster.

Experiment 2.

Two similar pieces of copper were taken, with the same degree of hardness, respectively, and immersed in similar solutions separately. The rates of corrosion did not differ appreciably in this case, the soft metal corroding, if anything, slightly faster than the hard. The actual figures in these two experiments were:

	Hard.	Soft.
1.	.60 per cent. loss.	.41 per cent. loss.
2.	.593 per cent. loss.	.603 per cent. loss.

These two experiments certainly bear out the theory that when two pieces of the same metal, one hard and the other soft, are immersed in an electrolyte, sea water, for instance, the soft metal assumes the positive condition and the hard metal the negative, and thus forms an electrolytic cell in which the hard metal will be rapidly eaten away. This fact would have considerable significance in the case of copper tubes and sheathing which are often badly corroded in sea water, and is probably the cause of that inexplicable phenomenon often noticed, namely that one part of a sheet or plate is entirely eaten away whereas the other part is quite sound. It is conceivable, aye probable, that pieces of metal used in construction work are not the same temper throughout, especially in long pieces; if this were so, pitting would occur at the hard area.

Experiment 3.

A strip of copper was prepared and was heated at several points along its length with a fine pointed flame, to anneal it. It was then immersed in a 20 per cent. solution of NaCl for 56 hours at a temperature of 50 degs. C. It corroded very slowly on account of its thickness, but the experiment was valuable for all that. The hard portions were covered with a blackish green scale, whereas the soft portions were conspicuous by their brightness in contrast to the hard portions. Whether this scale is protective of further action I could not ascertain. It is probably quite natural to the action. (See summary of results.)

Experiment 4.

A square piece of thin copper sheet was prepared, around the edges it was annealed and had a hardness of 20, in the center it had a hardness of 44. It was immersed in a large beaker of water containing 20 per cent. NaCl in solution and a small quantity of hydrochloric acid. It is kept at a temperature of 50 deg. C. for 24 hours. The corrosion was very considerable and there was a perceptible diminution of thickness in the center where it was hard. There appeared to be very small clusters of crystalline copper on the softer portions which might have been due to re-deposited copper, although this was not certain. It is evident, though, that the corrosion is electrolytic.

Experiment 5.

A similar sheet was prepared only it was annealed in the middle, leaving the edges hard. It was in a similar solution under similar conditions. This sheet corroded very badly; the edges being quite feathery, they had got so thin. The thickness of the original sheet was .006 inches, which had decreased to .005 inches on the soft portion and ,003 inches on the hard, that is, in the center it was .005 inches and around the edges .003 inches.

These experiments establish pretty firmly, in my mind, the above-mentioned proposition, and I think it is worthy of serious attention by the users of copper tubes and sheathing, and a few experiments might well be made on a large scale.

INFLUENCE OF GASES DISSOLVED IN THE CORROSIVE LIQUID.

Several statements have appeared in the literature of corrosion to the effect that carbon dioxide, dissolved in sea water, is very conducive to corrosion.

A few experiments were made on this question:

Experiment 1.

A piece of copper was weighed and immersed in boiled solution (to expel gases), and allowed to remain 48 hours, the bottle being tightly corked during the experiment. Loss, .15 per cent. As a comparison with this a similar solution and piece of copper was prepared *without* boiling. Loss, .60 per cent. This experiment seems to show that some gas in the solution has a very great effect on the corrosion.

Experiment 2.

A similar salt solution to the last was prepared, and a piece of weighed copper was placed in it, and a slow stream of oxygen passed in for 12 hours. Loss, .262 per cent.

Experiment 3.

Exactly the same as above except that carbon dioxide was passed in for twelve hours. Loss, .08 per cent. Oxygen seems to accelerate corrosion to a considerable extent. Carbon dioxide has apparently no perceptible action.

SUMMARY OF RESULTS OBTAINED.

1. The presence of hard and soft areas on a copper sheet or tube would cause local corrosion due to galvanic action, and in which the hard portion would be eaten away.

2. Dissolved oxygen is very conducive to corrosion. Carbon dioxide has no appreciable action (in salt water).

Additional Remarks.—The use of nickel or tin coatings would be ideal apart from their great cost. Nickel is hardly acted on at all by salt water, and neither is electro-deposited tin. Tinning, however, should never be resorted to, since it would have pin-holes through which the corroding liquid could penetrate to the copper and so form a galvanic couple between the copper and tin. Copper oxide has been advocated as a protective agent by Cohen, but the writer is inclined to dispute this. Two pieces of copper were taken, one was dipped in copper nitrate and ignited, and a film of CuO was left on it, while the other was left plain. They were both immersed in a salt solution for some time; the CuO was entirely dissolved off the copper, which had corroded as well; the other piece corroded about the same amount. Copper oxide is soluble in sea water, and therefore cannot offer any protection.

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THE NEW ARTIFICIAL ABRASIVE—BORO-CARBONE

By Walter C. Gold.*

During the last decade a marked change has affected the grinding wheel business. Instead of wheel manufacturers using Naxos Emery and Canadian Corundum almost exclusively, they are now largely using artificial abrasives. And this revolution in grinding wheels is bound to continue as already some of our largest wheel makers have practically abandoned the use of natural abrasives owing to the fact that the artificial ones are more pure, sharper and harder, thereby producing grinding wheels which are more rapid cutting, durable and safe. The latest grinding material is Boro-Carbone, manufactured in France. The physical characteristics of Boro-Carbone are: color, black; specific gravity, 3.8 (it is therefore somewhat lighter than emery, which is rated at 4.05); is very hard and sharp; has a splendid fracture and wheels made of this material show a surprisingly high tensile strength.

Boro-Carbone is produced through the use of Bauxite, the richest oxide of alumina, and electricity. Treated in an electrical furnace and subjected to an intense heat, it is practically freed of all foreign matter. The large crystals are crushed when taken from the electrical furnace and the resulting grains are passed over screens made from bolting cloth, the principal grain numbers being 10, 12, 15, 20, 25, 30, 40, 50, 60, 70, 80, 90, 100, 120 and 150. These grains are packed in bags of 150 pounds each. Boro-Carbone is, practically, a pure artificial corundum; it is without the impurities which adversely affect the natural corundum, and for this reason it is highly desirable for grinding wheels, as it can successfully withstand the tremendous kiln heat (about 2,500 deg. F.) without "fluxing" or the wheels warping.

For "fine grinding," such as is done on the Landis grinders, the Brown and Sharpe grinders and certain universal standard grinding machines, it is giving very excellent results. On this type of grinding it is absolutely essential that the grinding wheel be cool and rapid cutting and yet hold its shape with but comparatively little dressing. For burring certain kinds of castings and for general machine shop use, etc., the wheels are making very satisfactory records. These classes of grinding prove beyond question that Boro-Carbone is a grinding material of sterling worth.

As a polisher it is undesirable because the grains will not "break down" properly for polishing purposes—they are too hard and sharp and the glue cannot properly hold or bind them to the face of the polishing wheel. The fracture, too, is so keen that the material peels off the wheel entirely too rapidly. Emery possesses to a marked degree that peculiar property of toughness which is lacking in natural or artificial corundum. No substitute for emery as a polisher has ever been found, and it may be safely asserted that there never will be found any material which will displace it.

The new abrasive, Boro-Carbone, can be "bonded" successfully in the fine grains (as fine as No. 120 has been used) which substantially means that the very coarsest and very fine wheels can be produced by the vitrified, silicate and elastic or shellac processes. Although a new material for grinding wheel purposes, it is being used with such excellent results that still greater laurels will unquestionably be won for it in the process of time.

*The firm of Walter C. Gold, Philadelphia, Pa.

EDITORIAL

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CONTENTS

THE 1914 CONVENTION

The announcement mentioned on our page of Associations and Societies that the Allied Foundrymen's Associations will again hold their convention and exhibition at Chicago, Ill., in 1914—September 7 to 14, less than eleven months after the convention of 1913—may cause some surprise in some quarters, for it is the first time that the Associations have repeated consecutively their annual gathering in the same place. Heretofore the policy has been to meet in a different city each year.

However, we presume that the joint committee who studied the situation decided upon what they considered the best available site for the big industrial show, and it will be interesting to watch how successful such a repeat convention can be. Certainly Chicago is one of the few places that has large enough buildings to accommodate exhibitors and attendants, and it is also one of the few cities which are such centers of an enormous industrial population that there is always present considerable local interest in industrial and educational shows.

THE REPORT ON CORROSION

I have read with interest the second report of the Corrosion Committee of the Institute of Metals, and in my opinion the committee are no nearer finding out the cause and prevention of corrosion than they were when they started and, furthermore, nobody will ever find out a cause of corrosion which will cover all cases. My opinion is based on observations covering various kinds of corrosion extending over many years. The report can only be said to deal with the tubes actually used by Dr. Bengough and his colleague. The various tubes used show on analysis from .21 per cent. to .33 per cent. iron. This fact alone is sufficient to enormously detract from the value of the results. It is possible to obtain tubes containing from .01 per cent. to .05 per cent. iron, and I should consider that .1 per cent. iron was rather excessive, and I am pretty certain that many makers will agree with me. The percentages of lead in the 70/30 tube and the 70/29/1 is much higher than it need have been for tubes made for purely experimental purposes. In each case it should have been limited to .05 per cent. There are tubes on the market which are said to give excellent results in practice, which do not contain more than 0.1 per cent. lead and iron combined.

I have before me several cases of yellow metal sheathing which have lasted more than the usual length of time, and in each case there is about 1 per cent. lead, which is above the average. The corrosion of brass of any kind in sea water is due to electrolytic action in the metal itself amongst the microscopic constituents, and it can only be prevented by the careful selection of a suitable metal. I suggest that an alloy of copper 70 per cent., zinc 28 per cent., lead 1.5 per cent. and tin .5 per cent. would give good results.

ERNEST A. LEWIS.

NEW BOOKS

"FOUNDRY MACHINERY." By E. Treiber, 1913. Size, 4¾ x 7¼ inches. 140 pages including index. 51 illustrations. Bound in green board. Published by Scott, Greenwood & Son, London, England. D. Van Nostrand Company, New York. Price, $1.25. For sale by THE METAL INDUSTRY.

This work has been prepared in order to present clearly and concisely the purpose and advantage of mechanical appliances in the foundry. The foundry industry, although it remained for a long while in the rear-guard of progress and was content with the simplest, slowest and most economical working machinery, has been forced under pressure of competition to make such great strides that at the present time even small works will be found employing suitable machinery to great advantage, and this little book has been issued with the view of describing all of the latest and most up-to-date of foundry labor-saving appliances and devices.

The book is divided into nine chapters together with an appendix. These chapters take up in their regular order the machinery for treating molding material in the initial stages in the production of castings and carry these descriptions through the various classes of molding machines an processes simple and complete, hand, air and hydraulic, and closing with descriptions and illustrations of the various sorts of fettling or finishing and cleaning machinery. The appendix contains descriptions of hoisting and conveying apparatus. The book is one which will well repay any foundryman for its study.

"QUANTITATIVE ANALYSIS BY ELECTROLYSIS." By Alexander Classen. Translated by William T. Hall, 1913. Size, 6¼ x 9¼ inches. 308 pages. 52 illustrations. Bound in red cloth. Published by John Wiley & Sons, Inc., New York. Price, $2.50. For sale by THE METAL INDUSTRY.

The fifth edition of the German text of this book was so different from the previous editions that it has been found possible to make use of only two or three pages of the previous English translation in preparing this text. Very few changes have been introduced by the translator, with the exception of mentioning the work of Spear and Strahan on the Rapid Determination of Zinc. In the references to the literature, the names of the journals have been abbreviated according to the method followed in Chemical Abstracts, published by the American Chemical Society.

According to the above-mentioned report, "Fundamental geometrical and mechanical properties should be represented by italic small letters; energetic, thermal and chemical quantities by italic capitals; electrical quantities by Roman small capitals; optical quantities and mathematical ratios (without dimensions) by Greek small letters; special quantities of any kind by Greek capitals or small letters.

A most convenient and desirable book for anyone interested in the rapid chemical analysis of plating solutions. In fact this is a work that will be found most convenient to have in the library whether it be in a college, workshop or private house.

CORRESPONDENCE

WE CORDIALLY INVITE READERS' OPINIONS AND CRITICISMS OF ARTICLES PUBLISHED IN THE METAL INDUSTRY.

NEW COPPER ALLOY

To the Editor of The Metal Industry:

The United States Patent Office, Washington, D. C., under date of September 30, 1913, granted a letters patent, 1,074,485, to W. F. Nolan, of St. Paul, Minn., for a copper alloy. This copper alloy as outlined in the patent consists of the following: Copper, 98.15 per cent.; manganese, 1.48 per cent; vanadium, 1.48 per cent., and aluminum, 0.12 per cent.

We are enlightened from time to time with information received from the United States Patent Office in the form of specifications of letter patents and especially so in the case of the "Copper Alloy," noted above, and to Mr. William F. Nolan, of St. Paul, Minn., for the work he has done on said alloy. We are, however, thankful for new discoveries and re-discoveries of old facts. Is there not a legend to be found somewhere which says that the ancients knew how to temper copper. Just how this tempering was done seems to be a question. Tempering, as the term is generallv understood, can be accomplished by two methods; that is, by the addition to a metal or alloy of another metal, or alloy or by heat treatment. It seems that Mr. Nolan has been able to accomplish both. From investigation and from reliable and theoretical knowledge now in our possession it seems that the one method of hardening copper, that is, by heat treatment, has been proven a fallacy, and the only method of hardening copper is by the addition of various metals and metalloids.

Under the paragraph which reads: "These ingredients are compounded and used as follows," some information as to the method of compounding the manganese, vanadium and aluminum would certainly be of interest. Are we to understand from the information that the pure manganese, pure vanadium and pure aluminum are put in a crucible and melted down, or that an alloy of vanadium, manganese and aluminum are first put into a crucible, covered with the borax and the copper then introduced?

We also note further down in the paragraph: "While yet dark red, remove it (the casting) from the mold and immerse it in oil. In this way the copper will be about as hard as tool steel that has been fully hardened and then drawn to a blue color. If a greater or less degree of hardness is desired, increase or decrease the other ingredients of the compound without changing the quantity of the copper or brass to be hardened. If the article thus molded is to be drilled, turned, planed or filed, such work should be done before the article is immersed in the oil, and after the machine work is done the article should be heated to a dark red color and immersed in the oil. From this description it will be understood that the brass or copper having said compound mixed into it may have its temper drawn out by heat, and may be hardened at any time by heating it and immersing it in oil."

Is not this what we have been told the ancients were able to do; that is, temper copper the same way as high carbon steel may be tempered by heat treatment? It seems as though Mr. Nolan has discovered this fact, but if one were to search through the many volumes of information that have been published regarding the equilibrium diagrams of copper and its alloys he is unable to find any reliable confirmation of Mr. Nolan's discovery. That is, we are not able to find a confirmation of the heat treatment of the alloy in question; that is, an alloy of 98.15 per cent. of copper, 1.48 per cent. of manganese, 0.25 per cent. of vanadium and 0.12 per cent. of aluminum. We are, therefore, lead to believe that Mr. Nolan's discovery is not a discovery at all, but in some way or other he has "slipped up," so to speak.

Regarding the constituents of the alloy, manganese has been known as a hardener for pure metals for some time, the action of the vanadium is as yet not well understood. The object of the aluminum, we, of course, know. It would seem that a pretty good alloy could be made with the copper, manganese and aluminum, eliminating the vanadium.

New York, November 24, 1913. Seth G. Malby.

Shop Problems

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE OF THE METAL INDUSTRY. ADDRESS THE METAL INDUSTRY.

THE METAL INDUSTRY has had so many inquiries in reference to shop problems that have been previously published that it is deemed advisable in future to number each question. Since the inception of the department of Shop Problems 1,894 questions and answers have been published, without taking account of the many answered direct and by mail.—Ed.

CASTING

1,895.

Q.—Enclosed please find samples of castings that we are trying to make, but we cannot make them run. Would ask you to give a suggestion how to make them run and what metal to use. We are using German silver clippings.

A.—The German silver clippings should be run down into ingots and used at the rate of one-third scrap ingot and two-thirds new metal. The casting contains:

Copper	65 parts
Nickel	22 parts
Zinc	12 parts
Iron	¾ part
Aluminum	¼ part

If the nickel is cut to about 15 per cent. the castings will be easier to run.—J. L. J.

CEMENTING

1,896.

Q.—I should be pleased if you would kindly answer the following: In the asbestos packing of steam and water fittings or cocks for boiler mountings, the asbestos when first packed will stand the pressure, but after a little time the asbestos becomes saturated with water and then allows the pressure to escape. What acid, gum or cement could I mix with the asbestos to prevent the water from softening the asbestos?

A.—No very satisfactory material for this purpose is available. A cement composed of litharge and glycerine is often used for a hard joint.—J. L. J.

CLEANING

1,897.

Q.—Will you please give me a receipt for cleaning stove work before plating?

A.—The method used by a number of stove concerns in cleansing their stove parts previous to plating, is as follows:

First—Parts that have ground work, such as name plates or figured or scroll castings, that may contain burnt sand in crevices, etc., are pickled in a warm solution of hydrofluoric acid, using one part of the acid and two parts of water. The time of pickling depends upon the amount of sand the article contains. An immersion from fifteen to thirty minutes is usually sufficient.

Second—After pickling wash well in cold water and immerse in boiling water, to which is added a small amount of lime or water ammonia. This will neutralize the free acid in the pores of the metal.

Third—Dry the parts—usually they dry instantaneously from the boiling water—then scratch-brush the ground work with a steel wire scratch-brush. After this operation the articles are ready for polishing.

Fourth—After polishing, if the ground work contains much grease in the form of tallow used in the final polishing, known as greasing: then soak in gasoline and brush out, using a good, stiff plater's hand brush, or the articles may be cleansed by immersing in the usual potash dips, but the gasoline or benzine method saves considerable time. After the immersion in the potash, wash well in water, scour with fine pumice stone and tampico wheels or hand brushes; rewash, immerse in a 50 per cent. solution of muriatic acid and water; rewash well and plate direct in the nickel bath from thirty minutes to one hour.

Plain surfaces do not require to be pickled previous to plating.—C. H. P.

DIPPING

1,898.

Q.—Can you give me a good formula of a dip for Flemish brass?

A.—Flemish brass is mostly produced by the aid of a black nickel solution or an arsenic muriatic acid solution, using current for the purpose. To produce a dip the following method should be followed: Dissolve white arsenic in strong muriatic acid by the aid of heat, adding all the arsenic that the acid will absorb: when cold, bottle this and use it for a stock solution. Now arrange a jar or tank to hold sufficient water so that your articles can be easily immersed, keeping this water near the boiling point. Add as much of the stock solution of the muriate of arsenic as required to give the gray black for Flemish brass. At the same time add about a quarter of an ounce of sulphuret of potassium to every ten gallons of the solution so prepared. This dip should give you good results.—C. H. P.

FINISHING

1,899.

Q.—Can you give me a formula for a genuine dead black Bower barf for finishing iron lock knobs and escutcheons?

A.—Bower barf is a film of black magnetic oxide of iron. It is produced by first cleansing the articles and then sand blasting, if a sand finish is desired. The articles are then placed upon heavy iron wire frames and placed in a closed retort or furnace and heated to cherry redness. Dry superheated steam is then injected into the retort or furnace. This produced the black oxide upon the surface which are afterwards immersed in heated linseed oil when the articles are cool in order to bring out the rich black tone.—C. H. P.

FLUXING

1,900.

Q.—Please advise me what flux to use in welding cast iron, steel, brass, copper and aluminum.

A.—For aluminum:

Lithium chloride	33⅓ parts
Potassium chloride	33⅓ "
Sodium fluoride	33⅓ "

For steel:

Potassium chloride	3¼ parts
Boracic acid	16 "
Potassium chlorate	¾ "
Iron carbonate	3 "

For copper:

The addition of small amounts of phosphor copper during the welding operation is said to give good results.

For Brass:

Borax glass finely powdered and mixed with finely powdered brazing solder is generally used.

For cast iron:

It is usually considered necessary to remove the graphite from the cast iron surface to be welded, and this may be done by means of copper oxide. Brazing solder and borax as a flux are then used.—J. L. J.

LACQUERING

1,901.

Q.—Is it possible to obtain a lacquer which can be easily brushed on?

A.—A lacquer that can be easily brushed upon articles or used as a dip with equally as good results upon antique copper finishes consists of the following:

French varnish is cut in denatured or wood alcohol. As a thinner or reducer equal parts of fusel oil and amyl acetate. To apply with a brush use one part varnish and two parts of thinner. For dip lacquering use one part varnish and three to four parts thinner. The lacquer will dry in the air, but it is advisable to use heat for the purpose.—C. H. P.

OXIDIZING

1,902.

Q.—I should be pleased if you could inform me of a simple process by which small tin goods can be coated to represent oxydized or antique copper.

A.—We believe that an imitation of oxidized or antique copper upon small articles made from tin would prove more expensive than the regular method of copper plating, oxidizing and relieving.

The method used as an imitation of this finish, especially upon iron beds or articles of a similar nature, consists in immersing the articles in a quick drying paint of the color resembling the oxidized copper produced with liver of sulphur when the paint becomes dry copper. Bronze is mixed with quick drying gold size and sprayed upon the surface of the paint in irregular streaks to produce the imitation of the relief upon antique copper.

If the tin articles are of such a nature that they can be plated in a mechanical plating barrel this method will give the quickest results with the least expenditure of labor. Plate as lightly as possible and after plating immerse in a dilute and quite hot solution of liver of sulphur until a dark brown is produced; then wash and dry. Arrange a frame whereby a number of the articles may be placed on and then relieve in the usual manner with a small felt wheel and tripoli composition.

If the articles are of such a nature that they cannot be plated in a mechanical plating barrel then the quickest method is to have frames made to hold a number of the articles and then plate them for ten or fifteen minutes in a warm copper solution. Then follow with the other manipulations previously mentioned.—C. H. P.

LUBRICATING

1,903.

Q.—What can we use as a lubricant in drawing aluminum shells?

A.—Crude vaseline will be found the best lubricant for your purpose. Apply a little to the outside of the tubes or the inside of the die and in a like manner to the plunger. Vaseline can be readily removed from the tubes by rinsing them in benzine or gasoline and drying out in maple sawdust.—C. H. P.

MIXING

1,904.

Q.—In your October issue, in the answer to Question No. 1857, "Metals for Thermostatic Purposes," you state that in a widely-known thermostat a brass alloy composed of copper, zinc and tin is used in proportions necessary to produce a high co-efficient of expansion. In another you state that layers of brass and nickel are used. What I wish to know is, what are the proportions necessary or the percentage of each metal used in both cases? If you could give me these, I should be extremely obliged.

In the manufacture of thermostats to procure a high co-efficient of expansion:

88	per cent.	copper.
5	" "	nickel.
4	" "	zinc.
2	" "	tin.
1	" "	lead.

Care has to be used in melting. The nickel is placed in bottom of the crucible and the copper put in next, with a covering of charcoal. The tin is added when the metal is removed from furnace.—P. W. B.

1,905.

Q.—I enclose herewith some turnings I have obtained from a plug of water gauges to stand high or superheated steam. Please inform me of the mixture for same.

A.—The mixture you ask for is as follows:

Nickel	46½ parts
Copper	36½ parts
Tin	16 parts
Aluminum	½ part
Lead	½ part

—J. L. J.

SPOTTING

1,906.

Q.—Our gray iron castings show up copper spots after being oxidized. Can you tell us how to overcome this?

A.—Your trouble is probably due to porous castings. These pores become impregnated with the various solutions and work out, frequently removing the oxidized surface and the lacquer and exposing the coppered surface which frequently has a very stained apearance.

We suggest that you examine such exposed spots carefully. It might be an advantage to use a magnifying glass, if such spots as mentioned are noted. There is no doubt but that these spots are the cause of the trouble as this is the trouble experienced by many platers on this class of work, especially at this time of the year. In the winter such trouble does not occur.

The only remedy is to boil the casting out thoroughly in water to which is added 1 or 2 ounces of common red argols, then dry thoroughly by heat before finishing, such as polishing or lacquering. If these suggestions are followed no further trouble should be experienced.—C. H. P.

TESTING

1,907.

Q.—In one of your recent issues you gave a method of testing a silver solution in which you gave the weight of a gallon as 142 ounces. The example read as follows:

"Out of two ounces of the solution you realized 10 grains of silver, the weight of the gallon being 142 ounces, therefore a gallon contains 142 times 10 grains or 1420 grains or 59 1/6 pwt."

In another paper I found a similar problem which gave the weight of a gallon as 160 ounces. Is this gallon weighed out, or how is it obtained?

When you have several tanks of silver solution, can this method be used, or what method would be better to use, and is each tank taken individually; weigh out a gallon of each tank and figured accordingly.

A.—In the first method referred to for testing a silver solution the total weight of the gallon of solution was given as 142 ounces. This would include the water used for solution, the silver and cyanide content.

The second method given was based upon the Imperial or British standard gallon, being based upon the fluid measure of 160 ounces per gallon. It is advisable in making tests to weigh the solution as the silver and cyanide may vary in various solutions. In this country the United States standard gallon is used which consists of 128 fluid ounces.—C. H. P.

1,908.

Q.—Will you be good enough to explain the best way to prepare lead-tin-antimony alloy samples for microscopic examination in view of difficulty caused by the soft lead spreading over surface in polishing?

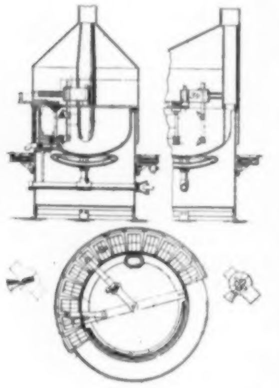
A.—The best way to prepare lead-tin-antimony samples for microscopic examination is to melt the samples under cyanide and pour through a charcoal made funnel upon a polished surface of steel or glass; mica may also be used. The alloy may be re-melted by the aid of a blow-pipe and a second sheet of mica pressed upon it until solidfication is complete. This procedure gives a very smooth surface.—J. L. J.

PATENTS

REVIEW OF CURRENT PATENTS OF INTEREST TO THE READERS OF THE METAL INDUSTRY.

1,075,592. October 14, 1913. **Melting Furnace.** Thomas W. Morrell, Bloomfield, N. J.

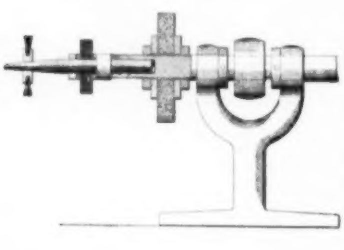
This invention relates to furnaces for melting purposes and particularly to furnaces for use in melting or re-melting metals having a comparatively low fusing point, such as type metal.



Among the objects of the invention is the provision of a furnace as shown in cut in which the metal in the melting pot may be thoroughly stirred and mixed during the melting operation, so as to produce a homogeneous product. I also provide a furnace which is of comparatively low cost, durable, easy to keep in order, and in which are embodied numerous improvements in details of structure.

1,076,022. October 21, 1913. **Attachment for Buffing Lathes.** Clyde Conner, Marietta, Ohio.

This invention relates to an improvement in an attachment for buffing lathes and has for its object to provide an attachment whereby the buffs will give greater service and are capable of being easily attached and detached.



Another object is to provide a device in which the polishing wheels, for example an emery, a cloth and a brush wheel will all be in proximity so that no time will be wasted in moving from one wheel to another; also to provide a device that will be easy to construct and cheap to manufacture.

1,076,455. October 21, 1913. **Alloy.** Walter Rübel, Berlin, Germany. Assignor to Rübel Bronze, Limited, London, England.

This invention relates to an improved iron-nickel-aluminum-manganese alloy, which is adapted to be mixed with metals to form other alloys, for example, it may be mixed with copper and aluminum to form a bronze.

According to the invention, iron, nickel, manganese, and aluminum are melted together in proportions corresponding to the multiples of their atomic weights, expressed in the following formula, viz:

$$4(FeNi)+8Al+Mn.$$

Thus

$$4(55.9+58.6)+8\times27.02+55$$

gives the following percentage composition: Iron 30.67, nickel 32.14, aluminum 29.64, manganese 7.54.

1,076,973. October 28, 1913. **Copper Aluminum Alloy.** E. D. Gleason, New York, assignor to F. J. Roesler, Brooklyn N. Y.

In describing his invention the inventor says:

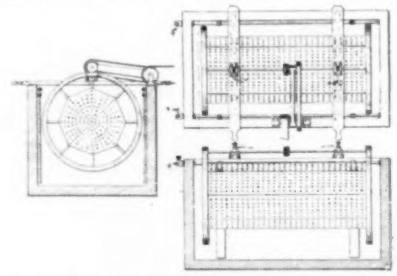
"In practicing my invention I incorporate boron in aluminum, as graphite exists in cast iron, by fusing them in a crucible, free from impurities, with a flux consisting of native calcium fluorid and fused vitrified boracic acid. For instance, in a crucible of magnesite, or graphite free from arsenic balls, I put three parts of calcium fluorid and on top of that, one part of fused vitrified boracic acid. I then fuse the same, preferably in an oxyhydrogen furnace of ordinary commercial type, until the fused mass of said two ingredients has reached the proper consistency; which is manifested by dense fumes of boron fluorid arising from the crucible. I then inject into the fused mass pure aluminum in ingot form. As aluminum melts at a comparatively low temperature, it fuses and absorbs the gases freed from the other ingredients. When said mass is fused, the molten aluminum is between two layers of boron fluorid, the top layer acting as a cover preventing oxidization, while the lower layer mixes with the molten aluminum. Thereupon, I cast the mixture of calcium fluorid, fused vitrified boracic acid and pure aluminum as ingots; the mass being well stirred and allowed to stand for a few minutes, in the crucible, before being poured. I then melt 90 parts of pure copper, in a crucible, under a cover of charcoal and black oxid of manganese, and while the copper is at high temperature I add thereto an amount slightly in excess of 10 parts of the boron aluminum product aforesaid."

1,077,480. November 4, 1913. **Process for the Treatment of the Surfaces of Articles of Aluminum.** Albert Lang, Karlsruhe, Germany.

According to the present invention it is possible to form an oxidized coating or layer on aluminum, this layer having good fire-resisting properties while it is permanent and can if desired be colored or enameled; the layer of color does not rest loosely on the material but becomes permanently bound with the oxidized layer. The oxidized layer may be produced either on the finished article or on the raw material.

The oxidation of the surface may be effected by the use of alkali, hydrochloric acid, or metallic chlorids in solution which latter at the same time produce a colored deposit. Such metallic chlorids may for instance be any of the chlorids of iron or copper. The aluminum object or sheet is dipped in the solution of alkali, hydrochloric acid or the like, or is brushed over with this solution, and the article is subsequently heated to a red heat or incandescence, whereupon, if hydrochloric acid or a chlorid has been used, the chlorin is driven off leaving a hydrate of aluminum, which latter is reduced to the oxid (alumina), on further heating.

1,077,646. November 4, 1913. **Electroplating Device.** Louis Schulte, Chicago, Ill., assignor to Bennett-O'Connell Company, of the same place. This invention relates to electroplating devices and more specifically to that class thereof designed for use especially in the electroplating of small articles.



The object of the invention is the production of an electroplating device, as shown in cut, of the character mentioned through the medium of which the electroplating of metallic articles may be effected economically with ease and expedition.

A further object is the production of an electroplating device through the use of which the cleaning, rinsing, plating, drying and polishing of the metal goods treated may be effected by one succession of operations without necessitating at each step in the process the removal of the goods from the container in which the same are arranged at the commencement of the operation and from which the same are removed after the completion thereof.

A further object is the production of a device of the character mentioned which will be of durable and economical construction and of high efficiency in use.

1,077,700. November 4, 1913. **Process of Making Lead-Copper Compositions.** Edward D. Gleason, of New York,

N. Y., assignor to Plastic Metal Company, of New York, N. Y., a corporation of New York.

This inventor has found that he can prevent the segregation and lead sweat of high lead bearing copper alloys by the use of lead sulphide. He says:

"The effect of my improvement is to provide a composition which is homogeneous in that the copper therein is comminuted to the greatest possible extent and equally distributed throughout the mass of the composition. I have discovered that the effect aforesaid is attained by adding to the molten copper, in the process of making such compositions, a non-metallic derivative of the other metal, capable of increasing the miscibility of copper with that metal, to wit, lead sulfid, and particularly the native lead sulfid, galena. For instance, I fuse 50 pounds of copper and add thereto 5 pounds of galena and then gradually add. to said mixture, 45 pounds of lead. The fused mixture is then poured into pig, ingot or other suitable molds, and, when congealed, fracture thereof shows that the cast metal is homogeneous.

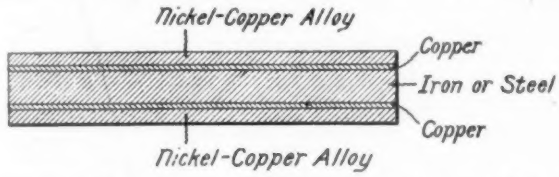
Harder alloys may be formed by taking 50 pounds of copper, 10 pounds of galena and 40 pounds of lead or 45 pounds of copper, 10 pounds of galena and 45 pounds of lead; said ingredients being mixed as in the first instance above described.

1,077,977. November 11, 1913. **Composite Metal.** T. S. Fuller, Schenectady, N. Y., assignor to General Electric Company, of New York.

This invention relates to duplex or composite metals and more particularly to metals of this character in which a copper-nickel alloy having nickel predominating is united to a ferrous metal in which iron predominates in such a way that the composite body of metal may be rolled, drawn and otherwise treated as a single metal.

One of the objects of the invention is to form a composite metal by uniting a metal of the general character of Monel metal to a less expensive metal such as iron or steel, so that the composite metal will have most of the essential properties of the Monel metal but will be less expensive and more easily workable.

The object is to produce a composite billet consisting of a layer of iron or steel coated on both sides with a film or layer of the nickel-copper alloy. Referring to the cut, 10 is a plate



of iron or steel. I have found that a steel comprising about 13/100 per cent. carbon and 36/100 per cent. manganese is very suitable for this purpose.

11 and 12 are plates of nickel-copper alloy in which nickel predominates. 13 and 14 are sheets of copper. The superposed bodies of metal are placed in a furnace and raised to substantially the melting point of the copper or somewhat above, but below the melting points of the other metals. This should be done in a non-oxidizing or inert atmosphere. A hydrogen atmosphere is particularly desirable as it readily reduces any oxids on the surface of the metals. However, the process may be carried out in an electric vacuum furnace utilizing carbon electrodes.

After the above-stated operation has progressed sufficiently to thoroughly melt the copper the composite billet may be removed from the furnace. It will be found that the metals are very intimately joined and even a microscopic examination will disclose practically no flaws. The composite billet may be readily worked as by rolling without effecting a separation of the component metal layers, and the rolling may be conducted at a high temperature or at a low temperature.

1,078,791. November 18, 1913. **Soldering-Stick.** L. Maes, of Bonn, assignor to Küpper Metallwerke Gesellschaft mit beschränkter Haftung, of the same place.

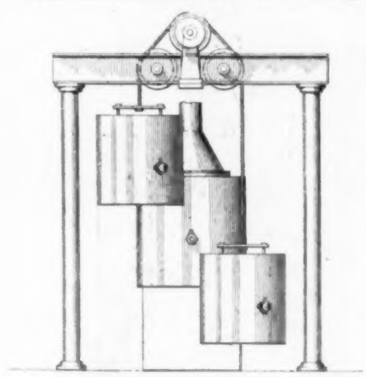
The present invention relates to a soldering stick of that kind in which finely divided soft solder as well as soldering fluxes or media are inclosed in a casing.

Soldering sticks ordinarily consist of a more or less hardened mass composed of wax, resin, sal-ammoniac, etc., with particles of tin-solder embedded therein, which is wrapped up in tinfoil or paper, or consist of a tube of soft-solder or a sheet of tinfoil which is filled with a mixture of fat, wax or the like and soldering fluxes or media, such as chlorid of zinc for example or which sticks have been made of a tube of solder filled with granular solder mixed with rosin. Both have the defect that the flux is present in excess and is melted with a slight amount of heat. These defects however are not only avoided by means of the soldering stick made in accordance with the present invention, but a large number of other advantages are obtained. For example strips or wires which are hidden in telephones may be soldered in the simplest manner without any fear that undesired connections, short circuits, etc., are formed by solder which drops down.

Good results are obtained, for example, when the casing consists of an alloy of 50 parts tin and 50 parts lead, and when the soft solder which is contained in the filling consists of 67 parts tin and 33 parts lead, or vice versa; naturally these relative quantities may be varied, and also these alloys may be composed alike and may also consist of other metals that may be used like lead and tin in soft solder. The soldering metal which is to be employed for the filling is preferably used in the condition of fine dust, the same being, for example, intimately ground to a waste with concentrated chlorid of zinc solution and cellulose or other agglutinant, in which also an addition of sal-ammoniac may be employed.

1,078,408. November 11, 1913. **Apparatus for Refining Lead.** J. F. Beattie, Hammond, Va.

The invention relates to refining, and its object is to provide a new and improved apparatus for refining lead by removing gold, silver, arsenic, antimony, tellurium, bismuth and other impurities.

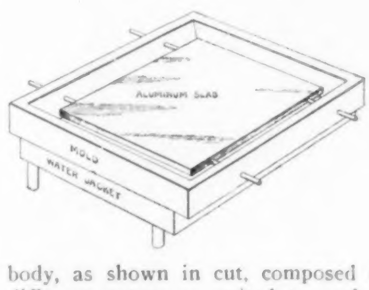


In order to accomplish the desired result use is made of two separate crystallizers and two separate kettles, the kettles having vertical movement to permit of running the resultant liquid in one crystallizer into a kettle to be transferred to the other crystallizer.

A practical embodiment of the invention is represented in the accompanying cut.

1,079,035. November 18, 1913. **Composite Metal Article.** L. B. Tebbetts 2d, St. Louis Mo.

This invention relates to composite metal articles, such as metallic sheets, made of layers of different metals having varying properties, the object in the production of such a composite metal article being to provide, in the same unitary metal body, layers of metal of a specifically useful function, and another layer of metal of a specifically useful function different from that of the first named.



A further object of the invention is to provide a composite metal body, as shown in cut, composed of certain specific metals of different nature so united to each other as to prevent the alloying of metal in one layer with the different metal in an adjoining layer.

EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST TO THE READERS OF THE METAL INDUSTRY.

AUTOMATIC SAND BLAST MACHINE

The machine shown in the cut is the New Haven automatic sand blast machine of the hose type, manufactured by the New Haven Sand Blast Company, New Haven, Conn.

This machine is said, by the manufacturers, to be controlled entirely by one valve; this is the air valve, and it controls the air and sand, and by opening and closing, the sand flows and stops automatically. It will be apparent, the manufacturers say, that this feature means a great saving of time, labor and expense. It is not necessary to close the sand valve to prevent the mixing chamber filling with abrasive and therefore necessitating adjustment each time the machine is placed in operation. The sand control is adjusted when the sand flow is placed in operation, and after this adjustment has been made to allow the desired amount of cleaning abrasive

FIG. 1.—HOSE TYPE NEW HAVEN AUTOMATIC SAND BLAST MACHINE.

to enter the mixing chamber, it is not necessary to touch it again; or, in other words, on this machine there is no sand valve to be kept in operation, so there is nothing to get out of order.

The cut (Fig. 2) of the mixing chamber shown here was by mistake included in the description of the self-contained sand blast barrel, manufactured by the same company, in the November issue of THE METAL INDUSTRY. This mixing chamber belongs to the automatic machine described above. The cut shows the simple construction of the mixing chamber, which is shown in the sectional view with hose connec-

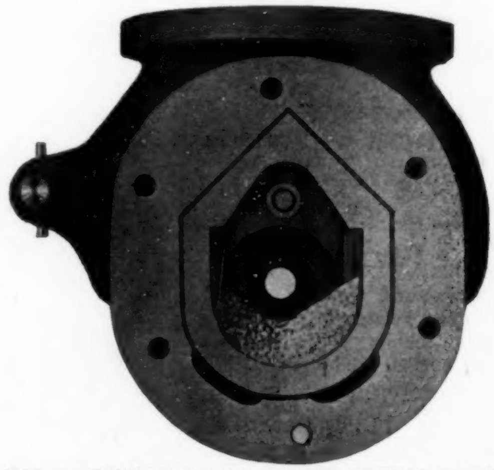


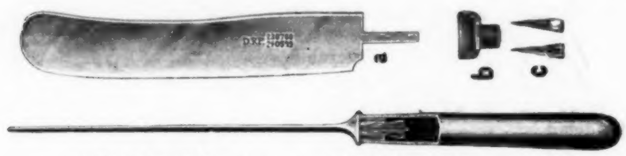
FIG. 2.—CONSTRUCTION OF THE MIXING CHAMBER. NEW HAVEN SAND BLAST COMPANY'S SAND BLAST.

tion removed, the interchangeable lining chamber in position, and sand entering side ports in the position it retains at all times. This machine is fully described in a new catalog M, just issued, which may be had upon request.

IMPROVED TABLE KNIVES

The knife shown in the cut is believed by the manufacturers to represent such a marked advance in the methods of manufacture of these articles as to cause a revolution in the cutlery trade. This knife is made without a crop, and the method has been patented in practically all countries.

As will be noticed in the cut, the blades are fixed by means of two wedges forced into a turned steel socket, the upper part of which is formed as a crop to balance the knife. This turned steel socket is soldered in the hollow handle of the knife, which may consist of steel, German silver or any other

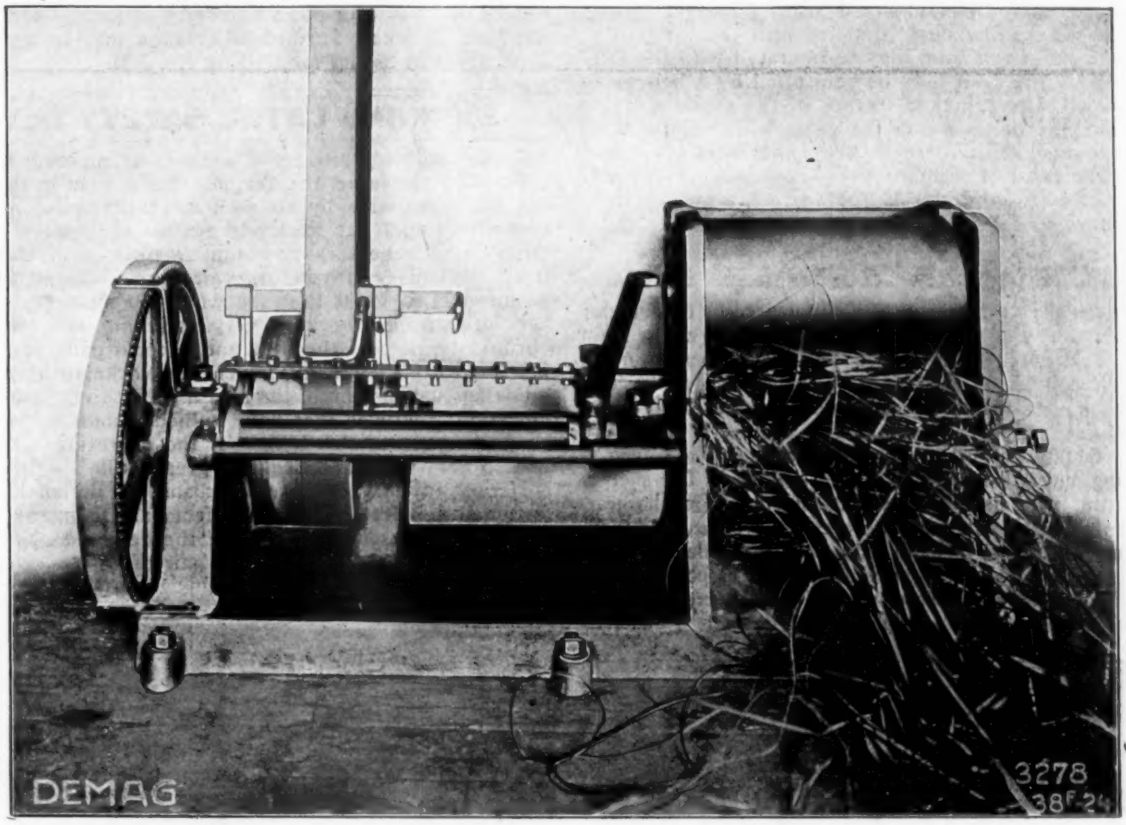


NEW METHOD OF ATTACHING KNIFE BLADES.

metal. The illustration shows very plainly the different parts. They are: the blades *a*, the turned steel socket *b* and the wedges *c*, and the handle. One of the great advantages of this knife, the manufacturers state, is that it is absolutely free from edges and corners and therefore can be kept clean at all times. The prime feature of the blade is that it is absolutely unmovable in the handle, while the blades made in the old fashion are fastened into the handles by the means of some kind of cement which becomes loose in hot water. The name of the patent holders of this process of knife manufacture is: The Patent-Besteck-Werke G. m. b. H., Berlin, Germany, and the United States representative of this firm is Charles Goethe, 1184 Jefferson avenue, Brooklyn, N. Y.

SCRAP BUNDLING MACHINE "SW"

This type of machine is designed to bundle scrap of great length into heavy bundles of 12 inches diameter and about 18 inches long. This machine is especially adapted for wire drawing mills, wire and strip rolling mills and other factories where long scrap results from the process of manufacturing. For instance, circular shears which are used for edging off strips turn out such scrap.



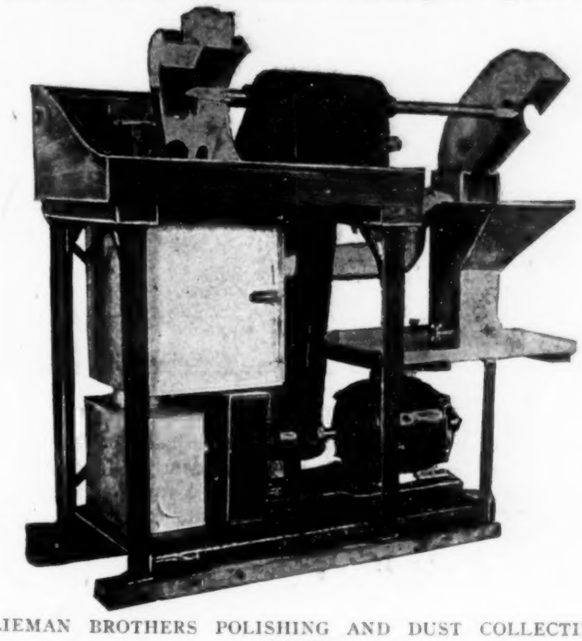
THE DEMAG SCRAP BUNDLING MACHINE.

The machine is built for either electric or belt drive, with loose and tight pulley. A gear operates the winding thorn, which is mounted with its conical shaft on a cast iron stand. On the end of the cone a slot is provided in which a long piece of scrap, wire, strip, etc., is introduced. The scrap for bundling if thrown in front of the machine is taken up by the wire or strip and so formed into a bundle. A weight is arranged over the thorn which is movable laterally, and the slots are provided for this purpose in the iron walls. This weight is also adjustable in the up and down direction, and thus tightens the bundle.

After the bundle is ready the thorn is moved by means of a hand lever towards the inside of the machine, and so removed from the bundle. After this, the ready bundle falls out in front of the machine. The weight of the machine net is 2,800 pounds. The capacity of machine is 42,000 pounds in a ten-hour shift. The diameter of the pulley is 19.7 inches, the width 4.25 inches, with 140 r. p. m. These machines are manufactured by the Engineering Products Company, 30 Church street, New York. This company manufactures a complete line of rolling and wire mill machinery which is described in Catalogue M.

NEW DUST COLLECTING POLISHING OUTFIT

Polishing work is receiving the attention of health and factory authorities all over the country to the extent that some means must be provided for sucking away the dust, whether the amount of work to be done is large and the operation of the shop continuous or the quantity small and the operation of the shop only occasional. Our illustration shows a new device of this kind. It will be noted that the blower or suction apparatus is directly underneath the bench in such a position as to create a powerful suction directly at the buffs. This constant stream of air draws in every particle of dust and deposits it in the tank shown. It is then subsequently removed, and if of value the latter is then easily recovered. Many devices for the removal of the disagreeable dust particles have from time to time appeared on the market, but this one is claimed to embody to a greater degree than any of them the principle of efficiency with compactness.

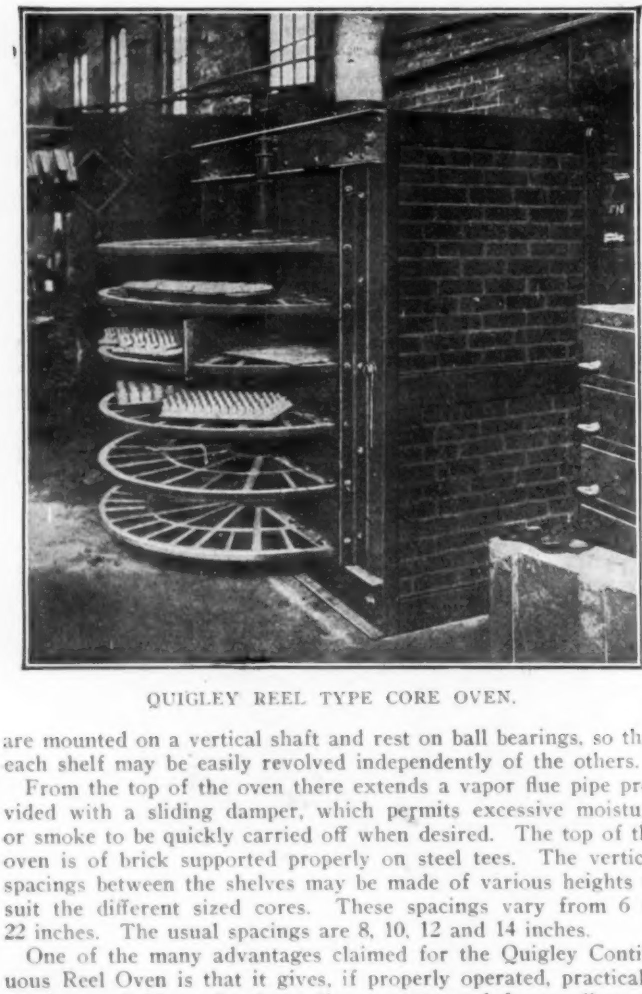


LIEMAN BROTHERS POLISHING AND DUST COLLECTING OUTFIT.

One side of the lathe is equipped with a long spindle. This allows ample working space for buffing on articles of considerable dimensions, such as trays, pitchers, silverware and articles of odd shapes. The hood over the buffs is of such construction as to allow the raising of the top and lowering the under section. This provides additional room for swinging these large pieces of work. The opposite side has a short spindle at which all small work may be easily polished and at the same time subjected to the powerful current of air which sweeps the dust particles into the lower dust tank. A machine of this kind may be operated with the electric motor as shown, or it may be connected by a belt to an overhead shaft. The principal feature of the machine, aside from its main one of removing the dust, is its compactness and power-saving ability, which the manufacturers claim places it at the head of machinery of this class. The outfit is made by Leiman Brothers, 62 John street, New York.

REEL TYPE CORE OVEN

The core oven shown in the cut is manufactured by the Quigley Furnace & Foundry Company, of Springfield, Mass., whose main office is 105 West Fortieth street, New York. The oven is known as the Quigley continuous oven and is built of first quality good hard burned red brick with the exception of the combustion chamber and perforated arch between the two chambers, which are built of first quality fire brick. The steel frame of the oven is self-supporting and is substantially bolted together. The shelves are of cast iron, made heavy to prevent distortion from the heat, and are in halves, each half bolted to a central vertical partition, which is amply insulated on both sides with air celled asbestos and covered with sheet metal to prevent as much as possible heat loss by radiation, thereby conserving the heat, decreasing fuel consumption and protecting the operator. The reels or shelves



QUIGLEY REEL TYPE CORE OVEN.

are mounted on a vertical shaft and rest on ball bearings, so that each shelf may be easily revolved independently of the others.

From the top of the oven there extends a vapor flue pipe provided with a sliding damper, which permits excessive moisture or smoke to be quickly carried off when desired. The top of the oven is of brick supported properly on steel tees. The vertical spacings between the shelves may be made of various heights to suit the different sized cores. These spacings vary from 6 to 22 inches. The usual spacings are 8, 10, 12 and 14 inches.

One of the many advantages claimed for the Quigley Continuous Reel Oven is that it gives, if properly operated, practically continuous baking. In the ordinary oven used for small cores, loaded on a shelf or truck, when the load in the oven is baked, the drawer or truck is removed and a fresh load is run into the oven or the baked cores must be removed from the drawer or shelf, and that portion of the oven is idle in the meantime. By reason of the great quantity of green cores entering the oven at one time the temperature is lowered, the oven is chilled and the length of bake is prolonged. Contrast this with this type wherein a small quantity of cores enter the oven at frequent intervals, not reducing the temperature materially and shortening the time of bake. Further information may be had regarding these ovens by asking for Bulletin No. 2-M.

SPINNING LATHE SAFETY DEVICE

In the ordinary process of shaping or spinning sheet metal objects on the lathe, the shaping tool is held in the hands of the workman who, by his own muscular power, presses the tool firmly upon the work and against a support. In shaping large lamp reflectors and similar objects in this manner, from thick disks of iron, brass or copper, the muscular effort required is so great that the workman must be strapped to the lathe. The work is very fatiguing and often causes chronic diseases of the liver and other organs, in addition to injuries to the left hand, which the workman uses to hold a guide against the rim of the rotating disk to prevent excessive vibration. Articles that have bulged cannot be worked into shape because of the danger of the operation. The process is also very slow and requires great skill.

Hermann Rahn, a master mechanic of Berlin, has patented an apparatus free from the defects and dangers mentioned above. The essential feature of the device, as shown in the accompanying illustrations, is a pair of levers. One of these levers serves as a guide and a support for the tool to which it

THE FIRST FIGURE IN THE PHOTO IS USING THE OLD-TIME TENSION STRAP; THE NEXT MAN HAS THE NEW DEVICE.

is attached, while the requisite pressure is applied by means of the second lever, which can be operated independently of the first. In order to enable one operator to carry on the entire process alone, the rim of the rotating object is guided by a roller and spring or some similar device, so that the left hand of the operator is left free to work the pressure lever.

In the simplest form of the apparatus the pressure lever is mounted on a pivot attached to the frame of the lathe, while the tool lever is connected with the pressure lever by a universal joint, and can therefore be moved freely in any direction. In a more complex form, adapted for a greater variety of work, the pressure lever is screwed into one of a series of holes in the periphery of a disk which is mounted eccentrically on a fixed pivot, while the pivot of the tool lever is inserted in one of a series of holes in the face of the disk at varying distances from the center. By this arrangement the leverage and the pressure can be varied without affecting the guiding of the tool, which is free to be moved in any direction desired. Other variations in the form of the apparatus are also available, but the principle remains the same.

Efficient operation of the Rahn spinning apparatus is so

easily acquired that an unskilled workman, after two or three days of practice, can turn out more work than can be accomplished in the old way by a skilled workman who has had years of practice. Furthermore, it is possible to work sheets of twice the maximum thickness used in the old process, and yet no straps or other devices need be used to increase the pressure. The average waste produced by unskilled workmen in the improved process is said not to exceed two pieces per thousand, while heretofore the most skilled operators have counted on a waste of from ten to twenty pieces per hundred. One of the greatest advantages in the new process, however, is the freedom from accident and diseases to which the operators are constantly exposed by the old method. For information regarding the patent rights for this device in America which are for sale, correspond with Engene Eichel, Charlottenburg 4, Berlin Waitzstr 7.

NEW TOOL AND DIE GRINDER

The Baird Tool and Die Grinder shown in cut was originally designed for the use of the Baird Machine Company, of Bridgeport, Conn., but the machine became so popular that the company was forced to take up its manufacture. The pedestal is heavy without having excess weight. Base is broad, 24 x 25 in., giving rigidness and stability. The column of pedestal is designed to maintain the rigidness of base without adding unnecessary weight. A greater thickness of metal is given to shoulder and strain points, reducing vibration and increasing strength. On operating side, the base tapers down to floor so that mechanic cannot trip, tumble, or stub against the edge.

THE BAIRD TOOL AND DIE GRINDER.

The adjustment of table is obtained both quickly and exactly. The bracket holding table works vertically on machined slides, a counter-weight inside pedestal allows of quick approximate adjustment by upward pull or downward thrust. It is immediately locked in position by hand wheel. Very fine adjustment is then made by means of a small wheel operating a screw feed of exact pitch. The adjustment for wear is a perfected part of the machine. An adjustment collar is given a slight turn forcing the bushing up against a check collar, the ground tapering spindle and tapering bronze bushing keeps a free running but absolutely tight bearing surface. No chattering of spindle or lateral movement. Wear is perfectly even and parts remain round and without flat spots. No wobble of any kind.

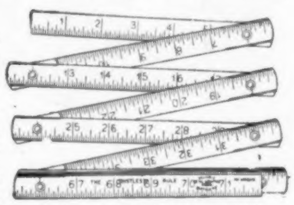
The equipment of the grinder includes two large diameter wide face emery wheels (12 x 1 in.), heavy wheel guards for each wheel, one wrench, one adjustable spanner, complete countershaft, tight and loose pulleys, belt shipper, etc.

Adjustable tool rest for one wheel.

Adjustable table for other wheel.

RUSTLESS RULE

The rule shown in the cut is manufactured of luminoy, which the manufacturers state is a special alloy of aluminum which has a beautiful bright surface and requires no polishing or rubbing to keep it so. It is claimed that the rustless rule cannot rust even though it is exposed to moisture, dropped in water or snow. Other advantages claimed for this rule are its light weight, as the rule weighs only a little more than an ounce per foot; then it is strong, durable and permanent. While it is as strong as steel, it is not brittle and will not break. The rule was approved by the Mayor's Bureau of Weights and Measures of the City of New York, November 17, 1913. This rule is manufactured by the Reliable Metal Stamping Works, Buffalo, N. Y., who are represented in New York City by the MacCoy Sales Company, 157 Chambers street, New York.

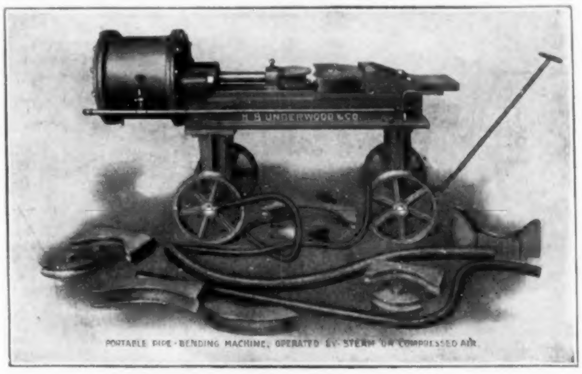


THE RUSTLESS RULE.

PORTABLE PIPE BENDING MACHINE

The machine shown in the cut is manufactured by H. B. Underwood & Company, Philadelphia, Pa., and is designed to be operated by steam or compressed air and, as will be noted, can be moved from one part of the shop to another very rapidly, due to the mounting of the carriage on ball-bearing wheels.

The piston is operated by air pressure of 80 to 100 pounds. The piston is forced back on the return stroke by a spiral spring projecting into a round boss of the cylinder head. The front head and piston rod require no packing. The end of the piston rod is supported in a crosshead, which slides in the guides.



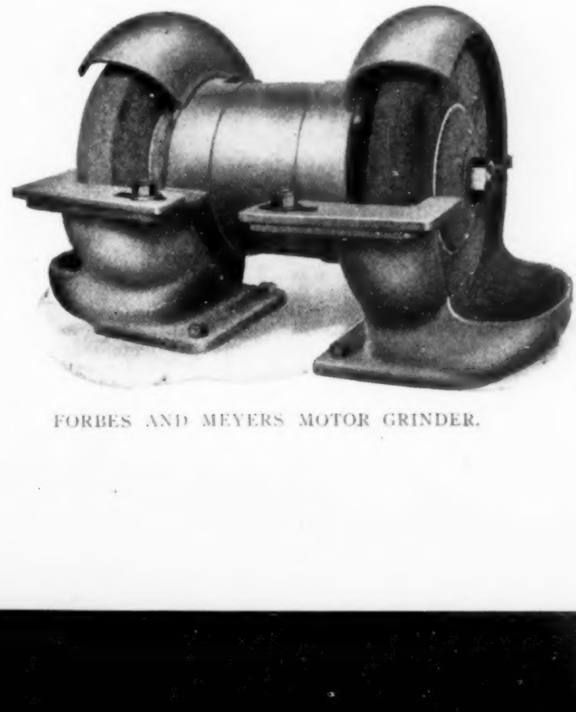
UNDERWOOD PIPE BENDING MACHINE.

The dies are easily and quickly changed. The female die is centered by a dowel in the angle-plate, which is adjustable along the bed-plate, bolted in place, centered and supported against the thrust of the air piston by large dowel pins.

This machine will bend any size pipe up to 2½ inches, cold and without filling, does not flatten or split the pipe and will put a right-angle bend in a 2-inch pipe in two minutes.

MOTOR GRINDER

The motor grinder shown in the cut has been designed by Forbes and Meyers, Worcester, Mass., to meet the requirements of the foundries, blacksmith shops and other places where heavy work is done. While designed primarily for heavy work, its smooth running qualities are said to make it equally serviceable for fine tool grinding. All electrical parts are absolutely protected against moisture, dust and mechanical injury. They never require attention. The best quality ball bearings are used. They are of ample size for any load which may be applied in grinding, and are protected from dust and grit by closely-fitting covers. These covers are provided with four deep grooves which effectually prevent the entrance of dirt along the shaft.



FORBES AND MEYERS MOTOR GRINDER.

Associations and Societies

REPORTS OF THE CURRENT PROCEEDINGS OF THE METAL INDUSTRY ORGANIZATIONS.

AMERICAN INSTITUTE OF METALS

President, G. H. Clamer, Philadelphia, Pa. Secretary and Treasurer, W. M. Corse. All correspondence should be addressed to the Secretary, W. M. Corse, 106 Morris avenue, Buffalo, N. Y. The objects of the Association are for the educational welfare of the metal industry. Annual convention with the American Foundrymen's Association in a succession of cities as invited. The next convention will be held in Chicago, Ill., September 7 to 12.

Secretary Corse says:

"The discussions from the Chicago meeting are being returned rapidly, and it begins to look as though Volume No. 7 would materialize by about the 1st of March, which is several months earlier than Volume No. 6. The number of illustrations, together with the size of the book, will exceed that of last year, and it promises to be by far the best volume that we have ever gotten out. The demand for bound volumes has been more than we anticipated, so that there are comparatively few of the back numbers available. My suggestion to members and to others interested is that they send in their order for complete sets of the numbers available, namely, Nos. 4, 5 and 6, as soon as possible. The special membership price is $2.50 a volume, and to non-members $3. The December bulletin will contain a complete list of members, both alphabetically and geographically arranged, and will be available for distribution about December 15. Our president, G. H. Clamer, has just appointed a committee on standard shapes and sizes of crucibles, and the secretary is waiting advice of the acceptance of the personnel of the committee. There is no question, however, but that the committee will undertake its work very soon and should have something important to report by next year's meeting. As you have been advised, the next meeting will be held in Chicago, the week of September 7, and, from all accounts, the arrangement there will be ahead of anything that we have ever had.

It is announced by the American Foundrymen's Association, American Institute of Metals, Associated Foundry Foremen and the Foundry and Machine Exhibition Company, through R. A. Bull, secretary of the joint foundry convention committee, that the conventions of the American Foundrymen's Association, the American Institute of Metals and the Associated Foundry Foremen, will be held simultaneously with the exhibit of the Foundry & Machine Exhibition Company in Chicago, from September 7 to 12, inclusive, 1914.

Representatives of the American Foundrymen's Association, the American Institute of Metals, the Associated Foundry Foremen and the Foundry & Machine Exhibition Company will meet the local committee at Chicago, January 17, for the purpose of completing arrangements for the entertainment features for the foundrymen's conventions to be held in Chicago, September 7 to 12 inclusive, 1914. The entertainment features are to be without expense to local foundry interests.

At the annual meeting of the National Founders' Association held at the Hotel Astor, New York, N. Y., on November 19 and 20, the following officers were elected for the ensuing year: W. H. Barr, president; Otto H. Falk, vice-president; J. W. Taylor, secretary.

AMERICAN ELECTRO CHEMICAL SOCIETY

President, E. F. Roeber, New York; Treasurer, Pedro G. Salom; Secretary, Jos. W. Richards, Lehigh University, South Bethlehem, Pa., to whom all correspondence should be addressed. The object of the society is the advancement of electrochemistry. Meets twice a year. The XXV General Meeting will be held in New York in April, 1914.

New York Section.

The next meeting of the section will be a joint one with the New York sections of the American Chemical Society and Society of Chemical Industry. Members of the American Institute of Chemical Engineers have also been invited to attend. The meeting will be held at 8:15 p. m., Friday, December 12, 1913, at the Chemists' Club, 52 East Forty-first street, New York City. Dr. B. C. Hesse, of the American Chemical Society, will preside.

The subject for the evening is: "Welfare and Safety Work in American Chemical Industry," and the programme is as follows: The New Jersey Zinc Company, Miss Florence Hughes, superintendent, Palmerton Neighborhood House; the Welsbach Company, Howard Lyon, experimental department; the National Lead Company, Charles P. Tolman, chairman, manufacturing committee; Harrison Brothers & Co., Inc., Dr. Francis D. Patterson, director of department of sanitation and accident prevention

The Spring meeting of the American Electro Chemical Society will be held in New York April 16, 17 and 18. On April 18 the American Electro Platers' Society will meet with the American Electro Chemical Society and papers on electro-plating will be read and discussed together with other papers on electro-refining, etc. In the evening the electro-platers will hold their annual banquet.

AMERICAN ELECTRO-PLATERS' SOCIETY

(AN EDUCATIONAL SOCIETY.)

President, Geo. B. Hogaboom, New York; Secretary, F. C. Clement, 462 North 50th St., Philadelphia, Pa. All correspondence should be addressed to the Secretary. The objects of this society are to promote the dissemination of knowledge concerning the art of electro-deposition of metals in all its branches. The society meets in convention in the spring of each year, subject to the decision of the executive committee. The next convention will be held the first week in June, 1914, at Chicago, Ill. The branch associations hold monthly and semi-monthly meetings in their various cities.

The regular monthly meeting of the New York branch was held at their rooms, 309 West Twenty-third street, on November 28. Vice-president Stremel presided over the meeting. Mr. John Corbit, of the Westinghouse Electric & Manufacturing Company, East Pittsburg, Pa., was elected to active membership. An interesting discussion was had on brass solutions and the spotting-out of work after plating

in cyanide solutions, the cause and prevention was debated and actual experiences set forth. A committee was appointed to make arrangements for the annual banquet and Mr. William Schneider was elected as chairman of this committee. The subject for discussion at the December meeting will be bronzing and oxidizing.

Details of the meeting of the Philadelphia branch, held November 7, are now available. THE METAL INDUSTRY mentioned the fact that a demonstration of trisalyt was made at this meeting, but we were unable at that time to give any definite information regarding the happenings at the meeting. The secretary reports that this meeting was one of the most enthusiastic and largest-attended meetings ever held by his branch. Among those present were, as mentioned before, C. H. Proctor, founder of the society; Dr. Weber, William Schneider and Carl Dittmar, the latter three representing the Roessler & Hasslacher Chemical Company. Founder Proctor gave a very interesting address in which he reviewed the causes which lead up to the formation of the society, and also recited the history of the association and told something of his hopes for its future.

Mr. Dittmar's Address.

Mr. C. Dittmar* made a few remarks preceeding a demonstration of Trisalyt which was as follows:

"The object of the American Electro-Platers Society is primarily the furtherance of the art of electro-plating and the exchange of ideas so that the individual may be benefited and enabled to better himself by improving the conditions that surround him in his daily work.

"This organization is composed of progressive men who are striving to raise the art to the plane that it should occupy. To obtain this end, the plater must keep step with all improvements which have been worked out for his benefit. The old-fashioned battery has given way to the more efficient and more stable dynamo. For small work the plater has adopted the mechanical barrel as a time and labor saver. In only one branch has he stood still, and that is in the chemical branch, which, after all, is the most important branch of electro-plating. In this branch practically nothing has been accomplished since the days of Rosseleur and others, whose methods and formulae have remained practically standard up to the present time.

"To elevate the art, the plater must strive to make himself more valuable to his respective employers and this can only be done by improving his product and increasing the output of his plant. He must, above everything else, strive to obtain maximum efficiency in his plating department. By obtaining maximum efficiency I mean he must strive to get the results required of him as quickly as possible and at the same time reduce the proportion of rejections to an absolute minimum.

"To obtain this ideal condition, the plater must use materials on which he can rely implicitly. There must be no guess work as to what he can expect from his solutions or their ingredients. He must standardize each and every one of his baths. This is absolutely impossible if the plater will adhere to his old methods which have been in use for several decades. Since that time the electro-plater has used the carbonate, chloride and nitrate of the various metals in his solutions and these only with doubtful success. This is true, not on account of lack of knowledge or experience on the part of the plater, but because of the fact that the plater has been compelled to use materials, the constituents of which he was often in doubt. He has had to use chemicals which contain a large proportion of inert salts and impurities which will ultimately, if not at once, cause trouble.

We have, therefore, taken upon ourselves, the problem of putting a salt on the market which contains only the ingredients necessary for results, that is, metal, cyanogen, and a reducing agent, and the results of our efforts have been to produce what we consider the ideal plating salt.

In TRISALYT, we are offering the plater a salt which he knows is correct both technically and practically—he has a salt which contains a guaranteed amount of metal—he has the correct amount of cyanide and free cyanide to obtain a uniform deposit. It further contains a conducting salt which draws the metal not from the solution, but from the anodes to a greater extent than is possible in the ordinary cyanide solution. (Mr. Dittmar incidentally here stated that while they did not care to be quoted authoritatively as yet, experiments had proven that "Trisalyt" would draw three times more metal from the anode than the old Carbonate bath.) TRISALYT is a culmination of years of investigation and practical trials both here and abroad, and you will agree with me, after you have seen the demonstrations which are about to follow, that TRISALYT will give the results you want when you want them, and you will readily appreciate the importance and advantages of this feature.

A further condition that must be taken into consideration is, that while TRISALYT is a departure from your present method, it must not be considered as an entirely new process. The TRISALYT method is simply an improvement or standardization of the cyanide process, and as such, the practical plater will be able to handle and control the same with certainty of success. The various problems which prevail in the cyanide solutions will show themselves in the TRISALYT solutions and should be handled accordingly. I might mention here, that the plater, in some instances, has had an erroneous impression in regard to TRISALYT in that he believed that in order to adopt TRISALYT it would be necessary for him to discard his present cyanide solution. This is not so, as TRISALYT can be added to his present cyanide bath to replenish the same. Such an addition can only be of benefit to the solution already made up. Knowing that the American Electro-Platers Society consists of progressive, and at the same time practical platers and chemists, we were indeed pleased to avail ourselves of this opportunity to show what TRISALYT will do in practical use.

Following Mr. Dittmar's speech Mr. Schneider made a practical demonstration of trisalyt for brass, copper, gold and silver plating. He mixed his solutions in site and explained how easy it was to manipulate them. The samples of work done at the Hartford Company's shop were put on exhibition, and the residue of the solutions was put back in the tubs, thus emphasizing the point made by the manufacturers of trisalyt that any plater need not throw away a solution in order to use Trisalyt, but may simply add these salts in place of single or double salts. After Mr. Schneider's demonstration Dr. Weber answered all chemical questions that were put to him.

*Roessler & Hasslacher Chemical Company, New York.

PERSONALS

ITEMS OF INTEREST TO THE INDIVIDUAL.

Nelson Flanagan, formerly superintendent of the brass foundry of the C. M. Grey Manufacturing Company, East Orange, N. J., is now connected with the Oxy Acetylene Welding Company, Waverly, N. J., in a similar capacity.

W. M. Corse, works manager of Lumen Bearing Company, Buffalo, N. Y., has resigned to become general manager of the Empire Smelting Company, Depew, N. Y., on January 1. H. P. Parrock, sales manager, will assume Mr. Corse's duties as superintendent, combining the two offices.

George B. Hogaboom, formerly foreman plater for the Archibald-Klement Company, Newark, N. J., has become connected with the P. & F. Corbin Manufacturing Company, New Britain, Conn., in the capacity of superintendent of the plating department.

Dr. Richard Moldenke, Watchung, N. J., secretary of the American Foundrymen's Association, and Walter Wood, R. D. Wood & Co., Philadelphia, sailed for London on November 15 to be away about a month in connection with the com-

mittee on specifications for pig iron and castings of the International Association for Testing Materials.

William R. Keavaney, of Waterbury, Conn., for ten years superintendent of the Waterbury Brass Goods Corporation of that city, a subsidiary of the American Brass Company, of Waterbury, Conn., has recently resigned. No reason has yet been assigned for Mr. Keavaney's retirement and he states that after an extended vacation he will make business plans for the future. While no information is available as to Mr. Keavaney's successor there are indications that H. W. Coe, who is now acting as superintendent, will be appointed to that position.

DEATHS

Ashmead Gray Rodgers, for twelve years general superintendent of The Carborundum Company plant of Niagara Falls, N. Y., died October 22 as the result of injuries received in an accident. Mr. Rodgers was born in Albany, N. Y., in 1872 and came to Niagara Falls twelve years ago from Hartford, Conn., where he was superintendent of the Eddy Electric Company. Mr. Rodgers was a practical as well as a theoretical engineer, and this, together with his tact and executive ability, made him a most important factor in the development of The Carborundum Company. He is survived by Mrs. Rodgers, a daughter, a son and two brothers, who live, respectively, in Detroit, Mich. and Hartford, Conn.

Howard B. Anthony, secretary and treasurer of the Michigan Brass & Foundry Company, Detroit, Mich., died November 20, after an illness of several months. Going to Detroit at an early age, he was first associated with the Michigan Stove Company and then became secretary and treasurer of the McRae & Roberts Company, brass founder. He leaves a widow and two daughters.

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS AND TRADE ITEMS OF INTEREST FROM THE DIFFERENT INDUSTRIAL CENTERS OF THE WORLD.

NEW BRITAIN, CONN.

December 1, 1913.

Business conditions in New Britain, the hardware center of Connecticut, are at this writing considered very fair in view of the season. The fall of the year is always a bad time for the manufacturers of builders' hardware such as is produced in this city, and a great deal of the work is necessarily on stock orders, the active building period for large contractors having passed by. In this respect the fall of 1913 is proving no exception. However, after the first of January the captains of industry anticipate a brisk renewal of business and look to their corps of salesmen to scurry through the country and obtain orders from the building contractors who are at this time of the year figuring on contracts for the spring and summer.

The P. & F. Corbin division of the American Hardware Corporation, New Britain's largest metal manufacturing concern, is at present adding materially to its working space, proving that the outlook for an increased trade is bright. The management is filling up the large building, formerly occupied by the now defunct Corbin Motor Vehicle Corporation, with all machinery necessary in the manufacture of the company's products. This building will be completely utilized shortly and will add several thousand feet of floor space without the expenditure of a large sum for the construction of a new building. The new addition to the main factory, mentioned in detail in another issue of The Metal Industry, is fast nearing completion. General business conditions at this concern are good, and while the orders do not require any overtime work, there is no evidences of laying off hands. There seems to be a marked increase in the special orders in this department. To show that business is holding its own, the Landers, Frary & Clark, the North & Judd Company and the P. & F. Corbin division shut down but one day for Thanksgiving, while the Stanley Rule & Level Company, the New Britain Machine Company, the Corbin Screw division and the Russell & Erwin division all closed for three days.

This is harvest time for the Landers, Frary & Clark people, as the coffee percolators, table cutlery, cake and bread mixers and other domestic devices of metal manufacture are much in demand for Christmas presents. The North & Judd Company also benefits by the holiday season on account of the belt buckles they manufacture. The Mexican war is another cause for a noted increase at this concern, as the Mexican dealers trade extensively with this factory in spurs and harness buckles. Reports from the Stanley Rule & Level Company are not as bright, yet are not alarming. The orders are not coming in very briskly, but there are at present enough stock orders on file to keep the factory busy until the salesmen again come into their own.

Turning again to the heavier part of the metal articles manufactured here, the Stanley Works, makers of wrought steel butts and hinges and cold rolled steel, are not over rushed, owing to a decrease in the building about the country, but nothing more than the annual early winter slackness is hinted at.

The Beaton & Caldwell Company, who a month ago purchased the Eagle Manufacturing Company, of New Jersey, has had all plans made for the erection of a new building, to be built alongside of its present factory. The building will be of cement and will be modern in every particular. The officials announce that construction will be started in the spring or early summer, and all tenants who occupy the houses on the site of the new shop have been ordered to vacate before May 1. All in all, conditions in the metal industry fields of New Britain are giving the heads no serious cause for worry and they seem quite optimistic regarding the future.—H. R. J.

TORRINGTON, CONN.

December 1, 1913.

Official announcement had been made by the heads of the Coe Brass plant of the American Brass Company that it is planning to erect a large casting shop in Torrington, Conn. Unofficially it is said that the cost of the improvement will be in the neighborhood of $1,000,000. Because of slack business conditions the date for the starting of building has not been selected, but it is expected that it will be erected inside of a year. The purpose of this plant is to provide better facilities for the increasing business of the company and the bettering of workmen's conditions. The present series of shops are not satisfactory in the matter of light and air. The concern is also cramped for storage room.

One reason given out as the one why building operations are not begun at once is that experiments have been going on in the method of brass casting, and when the new plant is built it will be equipped to do the casting in the latest manner, probably being unsurpassed anywhere for efficiency. Torrington has been happily free from labor troubles, and this is one reason why the new shop will be built here.—H. R. J.

BOSTON, MASS.

December 1, 1913.

In many lines the metal industry mirrors general trade conditions in this section. During the month of November there

has been a decided slowing down in the business activity of New England.

This is really the second touch of hesitancy this year that has made a noticeable impression upon industrial enterprises here. The earlier slowdown, which was recognized about the middle of the year, was to a large degree prophetic in its nature, like the shadow of the coming event, rather than the substance, and it was followed by sufficient recuperation to cause many of the manufacturers to consider it merely transient and lacking in significance.

There were many plants wherein the earlier temporary lessening of activity was not unwelcome, allowing an opportunity to overtake work that had somewhat accumulated, and had exerted pressure upon the proprietors to fill orders.

At the present time, however, with a new year at hand, few employers are as well satisfied with the outlook as they were a year ago. There is no desire to be quoted to this effect, but inquiry among silversmiths, copper and brass founders and other metal workers is productive, as a rule, of the information that, with few exceptions, they are not as busy as they would like to be, and they do not foresee an active year in 1914.

This must not be taken as meaning that the metal workers are very dull and in great need of orders. But there is less call for production than is usual in the period just before the Christmas holidays, and often when a man drops out of the working force, just as was said to be the case for a few weeks in mid-summer, he is not replaced with a new workman, and the vacancy seems more than heretofore likely to remain unfilled.

Scrannage Brothers, proprietors of the North Star Plating and Brass Works, formerly of 79 Traverse street, have given up their ground floor office at that number and use the entrance at 77 Traverse street, leading to their workshop in the upper part of the building, the office being now on the fourth floor.

It has been a very good year for the makers of prize cups and trophies in silver and bronze, workers in these lines having had practically all they could attend to in this city during the past three or four months. Walter I. Cowlishaw, who has taken new and enlarged quarters, the Tuttle Silver Company, F. W. Parris Silver Company, and others, all report long continued activity. Some of the chandelier makers have been busy also to a greater than normal degree, especially since the strikes of the early period of the year were settled. —J. S. B.

PROVIDENCE, R. I.

December 1, 1913.

Business among all lines of the metal trades, with the possible exception of the jewelry lines, has continued good up to the present time, although there has been a perceptible lagging during the last fortnight or so. Everybody seems to feel that with the new year there will be a resumption of business that will continue during the year. From now until spring most of the plants will operate either with a curtailment of forces or under shortened hours.

The Providence Cornice Company of this city has been awarded the contract for furnishing all the copper work on the new building of the local Young Men's Christian Association.

Christopher W. O'Brien, for several years a representative of H. F. Carpenter & Son, gold refiners, has severed his connection with that concern to engage in business for himself. The new firm is Almy & O'Brien, refiners, 44 Borden street. Mr. O'Brien's partner is William F. Almy, prominent as a refiner in this city and Canada for several years.

Alsfeld & Flynn have started in business at 31 Mathewson street, doing electro-plating, fire gilding and nickel plating.

The Providence Co-operative Sheet Metal Co., 142 Eddy street, this city, is being conducted by George L. Parker, Charles Bornstein, Abraham Gershkoff and Morris Woolf, according to information filed at the City Hall.

Fred C. Lawton, for the past fourteen years superintendent of the Gorham Manufacturing Company's extensive plant, has resigned his position, but the vacancy has not yet been permanently filled. Mr. Lawton has received several advantageous offers which he has taken under consideration. He entered the employ of the Gorhams over thirty years ago, beginning in a clerical capacity and passing successfully into several supervisory offices until he was appointed superintendent in 1899.

The Gorham Manufacturing Company has been awarded the contract for the main altar for the new Catholic Cathedral at St. Louis, Mo., to cost upwards of $100,000.— W. H. M.

BRIDGEPORT, CONN.

December 1, 1913.

While the industrial situation is not as bright as it might be, the slowing up has not greatly increased during the past few weeks. A few factories have laid off help, while others have shortened the working hours. The announcement of the fact that a few factories have decreased the working forces really does not mean a great deal, because in nearly every instance none of the regular hands or experienced help have been dispensed with. A large number of factories report a fair amount of orders on hand, but owing to the difficulties in obtaining money, the execution of these orders is not hurried, and thus they are able to get along on an eight-hour schedule or with less help.

The State Education Shop of Bridgeport is the recipient of a large and handsome case from the H. G. Thompson & Son Company, of New Haven, manufacturers of metal cutting saws and machinery. The case contains many of the products manufactured by this firm and should prove very instructive to the many students in the machine courses. A course in foundry work is soon to be installed at this trade school, and as all branches of foundry work will be taken up, it is expected that many men and boys now employed in the various foundries in this vicinity will receive a training that will be beneficial to themselves and employers.

George S. Youngs, maker of brass and composition ingot, is now offering for sale a very high grade of ingot copper. This is a new line and seems to be meeting with considerable favor in many foundries.

C. H. Woolard and A. Tucker are about to start a jobbing plating business. Both have had considerable experience in this line of work. Mr. Tucker was until recently with the Newfield Plating Company. All equipment for the new enterprise has been purchased.—L.

NEWARK, N. J.

December 1, 1913.

The condition of the gold, silver, platinum and other lines has not been as good as in former years, and the various firms have not been busy. There has been no night work such as is usual for this time of the year, and many hundred hands are said to have been laid off. It has been generally hard to get enough workers at this season of the year, but there has not been any scarcity this year. The Federation of Labor have been organizing this year, which is the first real attempt since the failure of the strike several years ago, and the shops since that have been conducted on the open shop basis. There are no lines that are really strong in demand. There is more or less demand for fine platinum work, which sells to the rich trade, and there is a demand for 10-karat gold and plated goods, but no demand for the high-grade gold goods, such as 14 and 18-karat. Sterling silver lines are only fair, while German silver has sold better. Mesh bags are still a strong feature, followed by vanity cases, purses, bracelets, chains, rings, scarf pins, lavallieres, etc. Bronze and brass novelties have had a ready sale. The plating, coloring, engraving, chasing, stone setting, jewelry repair, enameling and other such lines have had a quiet year, but engine turning has been much better, as it costs less than engraving and does not show any individuality.

The Finished Parts Casting Company are making dies for holding squares, a line gauge or miter. The casting comes out right from the steel mold and does not require any machining.

The Wiley-Crawford Company, jewelry manufacturers, have a saving fund for their employees, so as to provide for vacation time.

M. Alexander, manufacturer of jewelry, has added more machinery to make rings, and has increased the output.

J. Rosenbaum & Company, making German silver mesh bags, vanity cases and toilet sets, have been increasing the output and quality, since moving into their own building.

The Goldsmith-Koch Company, making sterling and German silver mesh bags, have been in bankruptcy. The shop has been closed, except for a time it was run by the receiver. Walker E. Smith, who was with Frank Kursh & Son Company, has been the new superintendent. A settlement of 50 cents on the dollar is being made, and the plant will continue business, with some new blood in the firm.

Henry L. Leibe & Son, making gold lorgnettes, have moved their plant from 24 Boudinot street to 276 Railroad avenue.

H. J. Schneider, chain manufacturer, has put in more machinery and improved the factory.

H. A. Taylor has taken some extra space for his findings factory.

Lindsley & Cook, platers, moved to the Strobell & Crane building.

Louis V. Aronson, of the Art Metal Works, has taken out a patent on a perpetual calendar.

Alfred Sandaz has much improved his facilities and output of gold and silver chain, mesh bags, vanity cases and novelties since moving from 56 Stratford street to 97 Chestnut street.

The Jennings Silver Company, of Irvington, opened a New York office at 214 Silversmith's building.

The Empire Jewelry Manufacturing Company are making some new lines of pendants and scarf pins.

Jacob Michelstein and David Karlins, who were with M. L. Ernst, of New York City, have opened a factory at 38 Crawford street, to manufacture gold jewelry, under the firm name of Michelstein & Karlins.

The Whitehead & Hoag Company have disposed of their plant in Washington street and their new factory is being rushed to completion, at Sussex avenue. It is a five-story, reinforced concrete building, 250 feet long, for the manufacture of brass, bronze, gold and silver badges, emblems, novelties, etc., also using considerable celluloid.

The Lindsay Novelty Works is a new firm at 16 Boyden place, making brass novelties, gold and silver plated. J. N. Lindsay has charge of the factory and F. T. Burch the selling in New York City.

The Lafayette Silver Company have kept making improvements and have a good force on now, being very busy with silver flat ware, having the best of designers. Have put in a polishing and plating plant.—H. S.

PHILADELPHIA, PA.

December 1, 1913.

Business in all lines is said to be somewhat quiet. The building records show a slump in the amount of money put in new buildings and the number of structures built are less than for several years. There is a lack of confidence which has held back general lines. Retailers, jobbers and manufacturers are holding back from buying and purchases of all kinds are not up to the usual mark. The continued high cost of living is one of the features, and instead of lowering any, seems to go still higher. The brass, bronze, aluminum, tin, nickel and other such metals are at times lively and other times dull, but on the whole are only fair. Gold, silver and platinum manufacturers have had a very quiet year.

The Philadelphia Patrol and Dispatch Co. has been formed to guard the Sansom street jewelry district.

Arguments on the Government's case against the Keystone Watch Case Company to dissolve that corporation has been postponed. This action has been brought under the Sherman anti-trust law, the defendant concern being charged with having absorbed other manufacturers of its kind, for the sole purpose of controlling the market.—H. S.

BALTIMORE, MD.

December 1, 1913.

There are considerable metal working lines here, and they are all quite busy. Manufactures of tin are very heavy, brass, bronze, aluminum are of fair proportions; there is not much gold or platinum trade, but silver is quite an item. The silver lines made are mainly in the shape of flat ware, novelties, buckles, etc. As a jobbing center this city looms up large, as the field through the south is naturally taken care of by the Monumental City. All lines are jobbed, and these branches are increasing. Twice a year the buyers come here, their expenses being paid, provided they purchase a certain amount of goods. The city is growing, large improvements are being made, still it is very backward in some respects, such as dirty streets, narrow business streets, etc., although great advances have been made in many ways since the big fire of about fifteen years ago.

John Wagner has abandoned his hunt for gold on Miller's Island, which was supposed to be buried there. He is now trying to locate a supposed hoard of gold, worth $13,000,000, between Back and Middle rivers.

Dr. Howard A. Kelly, the Baltimore surgeon, is at the head of a movement to establish free public radium clinics in the United States, one of which would be located here. Dr. Kelly, with Dr. James Douglas, of New York City, have purchased twenty-seven mining claims in Paradox Valley, Col., which are said to contain the richest deposits of radium in the world. The great difficulty is to keep the radium deposits out of the hands of capitalists who would seek to enrich themselves. About $120,000 worth of radium is on hand, which will be used for pressing cases, but $1,000,000 worth is needed. It will be used for the treatment of cancer and will be under the supervision of the United States Bureau of Mines, and the clinic itself will eventually become affiliated with the Johns Hopkins Hospital.

The J. Arthur Limerick Company at 960 North Howard street, have a very good plant, making gold, silver, brass and bronze military goods, novelties and household lines.

The Eagle White Lead Company, of Guilford street, make all lines at their factory in Cincinnati. At the office here is handled white lead, solder and a new line of plumbers' supplies.

The Henry E. Boehm Company, of 306 North Holliday street, will enlarge and take the building at 308 and will also start making specialties of brass and white metal. A machine shop will be put in: also buffing and polishing plant are making considerable of the white bronze bearings and bushings, which are cheaper and wear longer than the phosphor bronze.

William F. Focke, who used to run the Monumental Plating Works and later was manager of the Hamilton Plating Works, which firm went out of business at 4 West Barre street, is now with the Catlin Company, platers, of Washington.

Fred Wiber and Pool & Company are the oldest platers here. They are both doing well.

The Maryland Brass Metal Works built a brass foundry at Guilford street and Girard avenue.

The Coale Muffler and Safety Valve Company, of 1525 Guilford avenue, have sold their plant and will move and build in another location.

The Crown Cork and Seal Company have made extensive improvements to their plant at Highlandtown and will also erect in Guilford avenue another five-story factory, to take the place of the buildings sold to J. A. Bridges. The new factory here will be five stories in height and fireproof. Two large structures are also being erected at the first-named location. A plating plant has been added, in charge of John Timmerman. This firm makes tin bottle tops for soft drinks, and a milk-filling machine.

Frank B. Sloan & Co. and the O. K. Manufacturing Company, both working in metal, at 314 North Holliday street, were burned out, but will soon be repaired and in shape for business.—H. S.

WASHINGTON, D. C.

December 1, 1913.

A survey of the metal industry of Washington discloses a wide range of opinion on the part of the manufacturers—all the way from "fair' to "excellent." As a matter of fact, the

metal industry plays but a small part in the industrial field of the national capital. A visit to the various shops showed that the employees were all busy. While some of the bosses reported that business was not quite as good as could be expected for this time of the year, they all spoke in a hopeful tone as to the future.

The tariff has had but little, if any, effect in the metal industry here. But in speaking with an employee of one of the largest railroads, he stated that the tariff had had a most depressing effect on the price of scrap iron. He stated that scrap iron that brought $8.05 per ton previous to the tariff was now bringing $2.50 per ton; and that scrap iron which formerly sold for $13 is now selling for $8. This represents a semi-annual loss of about $1,250. There is considerable activity in the building line in Washington, and many of the manufacturers and others engaged in the metal industry look forward to doing some business in this connection. There is also a good deal of work being done in the way of repairs; in fact, this forms one of the most important features of the metal industry of Washington.

One section of the national capital is now passing through a transition; the residential section has moved farther toward the northwest, and the old residences are now being converted into business houses—stores, offices, etc. This change has given considerable work to those engaged in the metal industry, particularly in the stamped-ceiling line, as well as to the various other branches of the metal and plating trades.

The new city postoffice is fast nearing completion. It is one of the most beautiful of Washington's public buildings. There are several hundred rooms, all of which will be devoted to the business of the postoffice. The metal industry will be well represented in the various lines, particularly in the inside furnishings and equipment. Naturally, at this time of the year, trade in general is dull, and while conditions are not all that could be wished, all the manufacturers with whom the correspondent for The Metal Industry spoke, talked in an optimistic vein. There are a number of large projects pending in the building line, all of which will of course give work to all branches.—J. J. M.

LOUISVILLE, KENTUCKY

December 1, 1913.

At the present time things are somewhat slow in this section in the various branches of the metal industry, due not only to the somewhat general depression all over the country, but to the fact that the work of the coppersmiths in the distilleries is about over for the season. A well-known metal man who returned recently from trips East and then South spoke with great optimism regarding prospects for business, in spite of present conditions in the East, the good crops and high prices in the South indicating that business will be better in that secton, at least, than for a long time. Collections are reported as being better than for several years, and other indications are such that there is no room for doubt that the coming year will be one of unusual prosperity.

The Vendome Copper & Brass Works has found the season for distillery work, which has about closed, unusually short, as compared with normal years, indicating the rather general tendency on the part of the whiskey trade to delay opening, and to have no more repair work done than necessary. The Vendome has handled some rather good jobs, however, including an addition to a well-known distillery which has doubled its capacity only last year, the Vendome doing the work.

Matt Corcoran & Co. are one of the copper concerns in Louisville which report business in excess of that of last year, several large jobs helping to bring about this result at the Corcoran shop. Matt Corcoran, Jr., has returned from Canada, where he remained for a time to start off the company's crew on a large job there.

At the recent successful "Made-in-Owensboro" exposition, held in Owensboro, Ky., the Robertson Electrical Company had an interesting display demonstrating nickel-plating and metal-polishing work by electricity.

The Fletcher Enameling Company, of Anderson, Ind., is building a large plant at Charleston, W. Va., which is to be completed and occupied within a few months.

The C. Von Allmen Preserving Company, 103 West Walnut street, Louisville, is preparing to engage actively in the preserving business, and desires to investigate various kinds of equipment for that purpose, including copper coils and boilers. Catalogs and prices are desired for this purpose.

The Frank L. Michals Company, of Cincinnati, O., operating a brass foundry, has decided to remove its plant from the Ohio city across the river to Covington, Ky., where a building at Scott and Third streets will be used.

COLUMBUS, OHIO

December 1, 1913.

The metal market in Columbus and central Ohio is "shot full of holes," so to speak. Every metal, with the possible exception of babbitt, is off, and the demand is quiet. One of the causes for this condition is believed to be the tariff, which has caused a let-up in the activities of metal-using concerns generally. It is difficult to quote prices, as the dealer is inclined to take whatever is offered by the customer if within reason. This is true of brass, copper and aluminum. The supply on hand is fair, and since the demand is decreasing, softness has appeared in every variety of metals. There is a fair demand for babbitt, and prices are holding up firmly.

The new plant of the Ohio Metal Company was ready for occupancy December 1. It is 50 by 100 feet and erected of brick and cement. The plant is modern in every respect and is located close to a switch at Fourth street and Fourth avenue.

The General Metal Company, at present operating in Jersey City, N. J., under the name of the Miller Metal Works Company, is expected to transfer its plant from that place to Toledo, Ohio, by January 1. The company manufacturers the tubular parts of motor cars.

Contractor William Long recently was awarded the contract to construct a large addition to the fine plant of the Buckeye Aluminum Company, of Wooster, Ohio. The new part will be 55 x 60 feet and two stories high, and is to be used as additional manufacturing space, made necessary by a rapidly increasing business.

At Elyria, Ohio, Finkson & Buttenbender have the contract to erect the new addition to the plant of the Superior Metal Products Company. The new building will be 41 x 48 feet, constructed of structural iron and brick.

The Sanitary Company, of Cleveland, Ohio, has filed papers with the Secretary of State, changing the name to the Paragon Brass & Manufacturing Company.

The W. S. Ferguson Company has been retained as engineer to prepare plans and let contracts for a factory, to be erected for the Cleveland Metal Craft Company, of Cleveland, Ohio.

The Sterling Specialty Company, of Newcomerstown, Ohio, a new brass works secured by that village, was incorporated recently under Ohio laws at a capital of $40,000. The incorporators are Pittsburgh business men.

R. F. Nailler, manager of the Enamel Pipe Company, of Elyria, Ohio, has applied for the appointment of a receiver. The plant is a model one in all respects and has built up quite a business since its establishment here about five years ago.

The Mineral Point Zinc Company, of 140 Dearborn street, Chicago, has purchased a large tract of land at Tiltonville and will soon begin the erection of one of the largest zinc smelting plants in the State. The site includes thirty acres, and engineers have been busy for a month making the preliminary surveys.

The Kinhoff Bronze & Aluminum Company, of Cleveland, Ohio, has been incorporated with a capital stock of $15,000 to deal in bronze, aluminum and other metals. The incorporators are: Joseph Kinhoff, John Schober, Liea Kinhoff, Helen Schober and Carl P. Born.—J. W. L.

NEWS OF THE METAL INDUSTRY GATHERED FROM SCATTERED SOURCES

The Bristol Brass Company, Bristol, Conn., will erect a brick addition to its muffle building, 100 x 100 feet.

The Curtiss Dryer Company, formerly of Worcester, Mass., has moved to Millbury Junction, Mass. This company manufactures centrifical dryers, oil extractors, etc.

The Allyne Brass Foundry, Detroit, Mich., is erecting a one-story brick addition to its plant. This company operates a brass foundry, machine shop and plating room.

The Ivanhoe Metal Works, a subsidiary of the General Electric Company, has established a factory in Cleveland, Ohio, for the manufacture of steel reflectors and brass fixtures.

The London Foundry Company, London, Ont., Canada, has installed $10,000 worth of new machinery in their plant and expects to add to its foundry equipment in the near future.

The new office building of the American Brass Company, of Waterbury, Conn., is rapidly nearing completion. It is expected that it will be finished and occupied probably the latter part of this year or shortly after the first of next.

L. G. Delamothe, the well-known electro-plating expert who was the originator of the process for electro-plating flowers, wood and other non-metallic substances, has opened a large plating establishment at Oakland, Cal. He has taken his son, L. A. Delamothe, in as a partner.

The Continuous Zinc Furnace Company, Hartford, Conn., which for some time has been developing an electrical furnace for the smelting of zinc ores, is planning for the construction of a commercial plant in the spring to be located in Montana or Colorado. The company has recently made a large increase in its capital stock.

The contract has been awarded for the construction of a new plant for the Cleveland Metal Craft Company, Cleveland, Ohio. The estimated cost of the plant is about $10,000. This company manufactures metal furniture, such as desks, filing cases, etc., for office use and also complete shop equipment as lockers, bins, metal partitions, etc., for which the above building will be used.

The Miller Metal Work Company, of Jersey City, N. J., designers and makers of automobile and marine motor tube manifolds, bending, coiling and tapering of all kinds of pipes and tubes, announce that they will transfer their plant to Toledo, Ohio, about the first of next January. The factory building secured by the company in Toledo occupies 55,000 square feet and there is plenty of room for expansion as the new site covers 11 acres of ground.

The Boston Nickel Plating Company, 160 Portland street, Boston, Mass., announce that their shop has been remodeled and refurnished with new and up-to-date machinery and appliances and that they are in a better position than ever to do all kinds of plating in gold, silver, nickel, brass, etc. Sand blasting, polishing, buffing, oxidizing, fancy dipping, and they make a specialty of repairing and refinishing auto parts and lamps. This company is composed of C. S. Taylor, president and C. F. Campbell, vice-president.

It is stated in the Prib Krai that the American factory, Corbin & Co., which has in New Britain, Conn., an establishment employing 12,000 laborers, manufacturing door mountings, locks and keys, and has been exporting goods to Russia amounting to several million rubles, intends opening in Riga a branch house, as it will be more profitable to manufacture the goods at this place. The new factory will be situated on the Schlocksche Strasse on a site belonging to Mr. Intzé. The commercial and technical director, as well as the technical experts, are about to arrive from America.

The addition to the foundry of Foster, Merriam & Company, Meriden, Conn., manufacturers of cabinet hardware and brass and gray iron castings, will be 50 x 120 feet, and will be parallel with the old building and connected with it. The addition will be equipped with an overhead trolley system and other apparatus for handling material economically, and will house two cupolas which will run on different grades of iron. Employment will be given to seventy-five molders. Besides a foundry the company operates a metal working plant and plating room.

B. O. Bowers Company, chemical department, New York, announce through P. S. Brown, general manager, that they have placed in their demonstrating room a brass solution which they are now introducing in this market. This solution, they say, is the only one known that is capable of producing heavy deposits of brass in a commercial way. They will be pleased to demonstrate the solution at any time in their room, 136 Liberty street, and state that they will be able to prove that it is superior even to the finest quality of "close plating." They also are demonstrating their special electro-galvanizing salts which produce a deposit of the finest quality and has an incomparable lustre.

INCREASE OF CAPITAL STOCK

The capital stock of the Wolverine Brass Works, Grand Rapids, Mich., has been increased from $500,000 to $700,000. The company in the last three years has more than doubled its capacity by the erection of a new and modern factory building, and the increase of capital stock is to provide for this expansion.

REMOVAL

The Detroit Steering Wheel & Wind Shield Company, Detroit, Mich., have changed their name to the Metalwood Manufacturing Company, Leib and Wight streets, Detroit, Mich.

The Wm. F. Renziehausen Company, refiners of precious metals, sweep smelting, makers of sterling silver sheet and wire, fine silver anodes, etc., Newark, N. J., have changed their firm name to The Renziehausen Company.

The Bridgeport Testing Laboratory, industrial chemists, Bridgeport, Conn., announce that in order to accommodate their rapidly growing business they have moved their office and laboratory from 1119 Broad street to 388 John street, Bridgeport, Conn., where they will occupy the entire building. This increase in space and equipment will enable this company to render clients even better service than before and they extend a cordial invitation to their friends to inspect their new laboratory.

INCORPORATIONS

To manufacture brass castings.—The Niagara Brass Company, Inc., Buffalo, N. Y. Capital, $30,000. Incorporators: Adolph Spangelthal, J. H. Baer; all of Buffalo, N. Y.

To manufacture metal castings.—The Kinkopf Bronze and Aluminum Foundry Company, Cleveland, Ohio. Capital, $15,000. Incorporators: Joseph Kinkopf, John Schober and Helen Schober.

To manufacture aluminum and brass.—The F. S. & D. Mfg. Company, Inc., Syracuse, N. Y. Capital, $10,000. Incorporators: James W. Farrar, George N. Deas and Allen H. Smith; all of Syracuse, N. Y.

To Manufacture and Deal in Aluminum Ware of All Kinds.—The Banner Aluminum & Manufacturing Company, Wadsworth, Ohio. Capital $10,000. Incorporators: Harvey J. Heller, Charles E. Lozier, Emery T. Kunkler, George W. Farnsworth and Mrs. Mary E. Forbush.

GOVERNMENT NEEDS

Proposals will be received at the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until 10 o'clock a. m., December 30, 1913, and publicly opened immediately thereafter, to furnish at the navy yard, Mare Island, Cal., etc., a quantity of naval supplies, as follows: Sch. 6084, brass and copper rod and sheet, naval bronze, monel metal; Sch. 6085, brass and copper pipe and tubing; Sch. 6087, brass and copper wire; Sch. 6096, strip, sheet, and molded gasket. Applications for proposals should designate the schedules desired by number. Blank proposals will be furnished upon application to the navy pay office, San Francisco, Cal., or to the Bureau. T. J. Cowie, Paymaster General, U. S. N.

FOREIGN TRADE OPPORTUNITIES

[In applying for addresses at Bureau of Foreign and Domestic Commerce, Washington, D. C., refer to file number.]

No. 12057. Nickel novelties for advertising.—An American consular officer in Canada reports that a business firm in his district desires to be put in touch with American manufacturers of nickel novelties for advertising purposes, with a view to making direct purchases.

No. 11791. Metal fittings.—An American Consul in a European country reports that a local firm desires to communicate with American manufacturers of metal fittings. The firm wishes to purchase direct from the American manufacturer and not from a general European agent or jobber.

No. 11843. Aluminum dust and caustic soda.—A report from an American consular officer in Canada states that a hardware firm in his district desires to purchase as wholesalers aluminum dust to be used in a cyanide precipitation process and also caustic soda, solid and powdered.

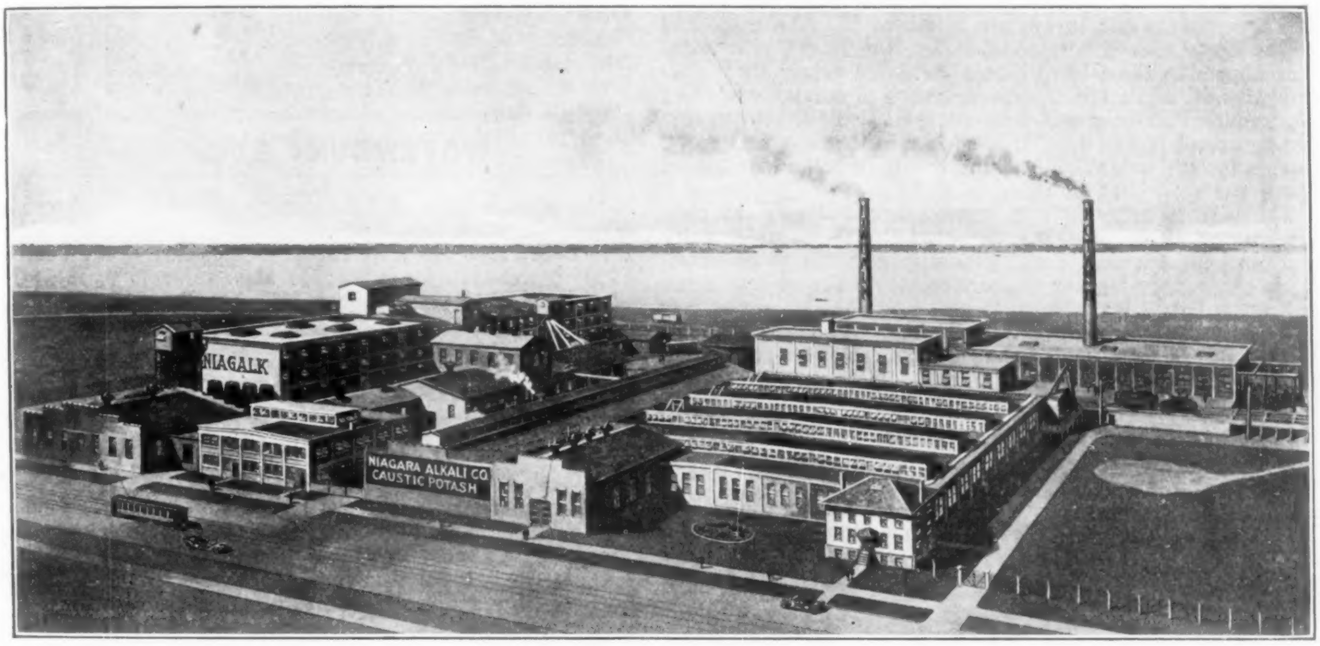
No. 11996. Hardware, novelties, tools, etc.—A business man in Germany informs the Bureau of Foreign and Domestic Commerce that he desires to secure the agency for American exporters of articles in the hardware line; novelties in metal, wood, leather, and paper; tools and fixtures of any kind, these articles being patented or otherwise.

No. 12053. Lacquer for brass.—An American consular officer in South Africa reports that a resident of his district is anxious to get in touch with American manufacturers of lacquer for brass, preferably Zapon lacquer. He would be glad to receive communications from such manufacturers as soon as possible. Catalogs should be sent to the officer forwarding the inquiry for his files.

PRINTED MATTER

Die Castings.—The Payne Die Casting Company, of Indianapolis, Ind., which has just been incorporated, have issued a booklet giving a description of the process which they employ for the making of Parsons' manganese bronze die castings. This booklet states that this company has successfully overcome the heretofore insurmountable difficulty resulting from the very high temperatures at which the yellow metals must be worked in order to make die castings, and they have made available die castings of much greater strength and durability than are possible in the white or low melting point alloys. The booklet makes very interesting reading and may be had for the asking.

South American Year Book.—The Louis Cassier Company, Ltd., London, England, have published the South American Year Book, incorporating the South American Railway Year Book for 1913. This book contains general information relating to the ten republics of the continent of South America, British, Dutch and French Guiana, the Panama Canal and the Falkland Islands, and is compiled and edited by C. S. Vesey Brown. This work, which is a handsome volume of 636 pages and 7 x 10¼ inches in size, contains a complete description of the railways, republics and colonies of South America. The work is divided into two parts, the first of which is devoted to the railways of South America, of which separate maps are given with each description. The second part of the work relates to general information of the ten republics and colonies of the southern continent. The idea of this work is not to supersede in any way the information now disseminated by consular reports and other independent returns, but merely to collate them in a concise form for ready reference. This book can be obtained from THE METAL INDUSTRY at a price of $8.50 per copy.



NEW HOME OF THE NIAGARA ALKALI COMPANY, NIAGARA FALLS, N. Y., WHICH INCREASES THEIR CAPACITY FROM 6,000,000 TO 20,000,000 POUNDS OF CAUSTIC POTASH PER YEAR.

CATALOG EXHIBIT

An exhibition of every kind of catalog may be seen at The Metal Industry office, 99 John street, New York. The Metal Industry is prepared to do all of the work necessary for the making of catalogs, pamphlets, circulars and other printed matter. Estimates will be furnished for writing descriptions, making engravings, printing, binding, for the entire job from beginning to end or any part of it.

METAL MARKET REVIEW

New York, December 8, 1913.

COPPER.

The larger selling agents after holding to their price of 16⅞, dropped prices to 15½ cents, but that action only seemed to further weaken buyers' views and the market sagged off to around 14¾ without attracting very much business.

Home consumers overbought in October and November and have been able to get along without coming into the market for any December delivery, some consumers will carry over copper into January, but there has been very little January-February copper bought and consumers will have to cover for the next two months' needs. Copper meanwhile has been accumulating and for January, February and March every one has copper to sell.

Germany came into the market about the 20th of the month and there were some good sales made for export and home buyers also bought, but with a further decline in the London standard market the buying movement ceased.

Statistically, the market does not look as strong as the last few months and during the month of October, according to the Copper Producers' Association, the stocks of marketable copper in the United States increased nearly three million pounds, while the European stocks of copper, including Rotterdam, Hamburg and Bremen, increased 790 tons during the month of November. It is estimated that the Producers' figures for the month of November will show an increase of about twelve million pounds.

The market today is very unsettled, consumers are only working on an average, say, of about two-thirds of capacity and until the business world generally gets out of its pessimism the copper market is likely to stay more or less weak and unsettled.

Prices today are more or less nominal. Producers will sell electrolytic at 14¾ and Lake is obtainable at around 15 cents, with casting offered at around 14½ cents.

TIN.

The trend of the tin market generally during the month has been towards lower values and prices today are about ¾ of a cent a pound lower than a month ago.

The statistics for November show an increase in the visible supply of about 3,000 tons and with some months yet of poor American deliveries, prices may show further declines. Spot tin 5-10-ton lots, is quotable at around 37¾ cents with futures a few points higher.

LEAD.

The Trust reduced the price of lead to 4¼ cents, New York basis. This is a drop of $2 per ton. The market had been more or less weak and independents were selling below the official trust prices. On December 2 the trust further reduced lead 15 points to 4.10 New York basis.

Market today 4.10 New York, with St. Louis 4 cents.

SPELTER.

The spelter market is rather easier and prices are about ¼ cent per pound lower, while the tendency seems to be towards lower figures. New York today, 5.30 carload lots, and 5.10 to 5.15 East St. Louis.

ALUMINUM.

The aluminum market has settled down to about 19 cents basis for the foreign and domestic article. The market is very dull with consumers buying slowly.

ANTIMONY.

Prices about the same as a month ago. Cookson's, 7½ cents; Hallett's 7.20, with Hungarian grade at around 6¼.

SILVER.

The silver market has been more or less weak and prices today are lower than a month ago. New York, 57¾, with London at 26¾d.

QUICKSILVER.

No change in price and the wholesale market is quoted at $38 a flask with jobbing houses asking $38½ to $39.

PLATINUM.

Market is shade easier with hard quoted $46 to $47 per ounce, and ordinary refined at $42 to $43.

SHEET METALS.

The price of sheet copper was reduced December 1 to 20¼ cents base; this is a reduction of 1¾ cents in sheets, while ingot coper has declined 2 cents. High sheet brass is reduced to 14¾ cents, and seamless brass tubing to 19½ cents. Other brass products have been reduced accordingly.

OLD METALS.

The weak and unsettled copper market has had its effect on all copper scrap and the market is weak at lower prices. Buyers are holding off and Europe is not buying.

NOVEMBER MOVEMENTS IN METALS

	Highest.	Lowest.	Average.
COPPER.			
Lake	17.25	15.00	16.20
Electrolytic	16.75	14.65	15.50
Casting	16.50	14.35	15.25
TIN	40.25	39.40	39.90
LEAD	4.40	4.25	4.40
SPELTER	5.40	5.20	5.35
ANTIMONY (Hallett's)	7.70	7.40	7.55
SILVER	59⅞	57⅞	59.00

WATERBURY AVERAGE

The average price of Lake Copper per pound as determined monthly at Waterbury, Conn.

1912—Average for year, 16.70. 1913—January, 17; February, 15.50; March, 15⅛; April, 15.75; May, 15⅞; June, 15⅜; July, 14¾; August, 15⅝; September, 16⅞; October, 16⅞; November, 16¼.

COPPER PRODUCTION

(Issued by the Copper Producers' Association.)

Combined reports of November 8 and December 8, 1913.

			Pounds.
Stocks of marketable copper of all kinds on hand at all points in the United States, October 1, 1913			29,793,094
Production of marketable copper in the United States from all domestic and foreign sources during October and November, 1913			273,158,189
	Pounds.		
October	139,070,481		
November	134,087,708		
			302,951,283
Deliveries:			
For domestic consumption		116,830,578	
For export		138,191,276	
	Pounds.		
October	136,297,193		
November	118,724,661		
			255,021,854
Stocks of marketable copper of all kinds on hand at all points in the United States, December 1, 1913			47,929,429
Stocks increased during the month of October			2,773,288
Stocks increased during month of November			15,363,047

DAILY METAL PRICES

We have made arrangements with the New York Metal Exchange by which we can furnish our readers with the Official Daily Market Report of the Exchange and a year's subscription to THE METAL INDUSTRY for the sum of $10. The price of the Report alone is $10. Sample copies furnished for the asking. We can furnish daily telegraphic reports of metal prices. Address THE METAL INDUSTRY, 99 John street, New York.

Metal Prices, December 8, 1913

METAL PRICES.	Price per lb.
COPPER—PIG AND INGOT AND OLD COPPER.	Cents.
Duty Free. Manufactured 5 per centum.	
Lake, carload lots, nominal	15.25
Electrolytic, carload lots	14.75
Castings, carload lots	14.50
TIN—Duty Free.	
Straits of Malacca, carload lots	37.75
LEAD—Duty Pig, Bars and Old, 25%; pipe and sheets, 25%. Pig lead, carload lots	4.10
SPELTER—Duty 15%. Sheets, 15%.	
Western, carload lots	5.30
ALUMINUM—Duty Crude, 2c. per lb. Plates, sheets, bars and rods, 3½c. per lb.	
Small lots, f. o. b. factory	23.00
100 lb. lots, f. o. b. factory	21.00
Ton lots, f. o. b. factory	19.00
ANTIMONY—Duty free.	
Cookson's cask lots, nominal	7.50
Hallett's cask lots	7.20
Hungarian grade	6.50
NICKEL—Duty Ingot, 10%. Sheet, strip and wire 20% ad. valorem.	
Shot, Plaquettes, Ingots. Blocks according to quantity .40 to	.45
ELECTROLYTIC—3 cents per pound extra.	
MANGANESE METAL—Duty 10%	.90
MAGNESIUM METAL—Duty 25% ad valorem (100 lb. lots)	1.50
BISMUTH—Duty free	2.00
CADMIUM—Duty free	.90
CHROMIUM METAL—Duty free	.98
QUICKSILVER—Duty 10%	.55
	Price per oz.
GOLD—Duty free	$20.67
PLATINUM—Duty free	45.00
SILVER—Government assay bars—Duty free	.58½

INGOT METALS.			Price per lb. Cents.
Silicon Copper, 10%	according to	quantity	27 to 32
Silicon Copper, 20%	"	"	34 to 36
Silicon Copper, 30% guaranteed	"	"	36 to 38
Phosphor Copper, guaranteed 15%		"	22½ to 28½
Phosphor Copper, guaranteed 10%		"	23. to 27
Manganese Copper, 25%	"	"	25 to 29
Phosphor Tin, guaranteed 5%.	"	"	61 to 63
Phosphor Tin, no guarantee	"	"	43 to 46
Brass Ingot, Yellow	"	"	10⅜ to 10⅞
Brass Ingot, Red	"	"	13¾ to 15
Bronze Ingot	"	"	13¾ to 14¼
Manganese Bronze	"	"	18½ to 20
Phosphor Bronze	"	"	20 to 23
Casting Aluminum Alloys	"	"	17 to 19

PHOSPHORUS—Duty free.
According to quantity .... 30 to 35

Dealers' Buying Prices. Cents per lb.	OLD METALS.	Dealers' Selling Prices. Cents per lb.
12.75 to 13.00	Heavy Cut Copper	14.00 to 14.25
12.50 to 12.75	Copper Wire	13.50 to 13.75
11.25 to 11.50	Light Copper	12.50 to 12.75
10.50 to 10.75	Heavy Mach. Comp.	12.50 to 12.75
7.25 to 7.50	Heavy Brass	8.75 to 9.00
6.25 to 6.50	Light Brass	7.75 to 8.00
7.50 to 7.75	No. 1 Yellow Brass Turnings	8.00 to 8.50
9.50 to 10.00	No. 1 Comp. Turnings	10.75 to 11.00
3.50 to ——	Heavy Lead	—— to 3.90
3.75 to ——	Zinc Scrap	4.15 to 4.25
6.00 to 7.00	Scrap Aluminum Turnings	8.00 to 9.00
12.00 to 13.00	Scrap Aluminum, cast, alloyed	14.00 to 15.00
14.00 to 15.00	Scrap Aluminum, sheet (new)	16.00 to 17.00
23.00 to 24.00	No. 1 Pewter	25.00 to 26.00
20.00 to 23.00	Old Nickel	20.00 to 23.00

PRICES OF SHEET COPPER.

BASE PRICE, 20¼ Cents per Lb. Net.

SIZE OF SHEETS.		64 oz. and over.	32 oz. to 64 oz.	24 oz. up to 32 oz.	16 oz. up to 24 oz.	15 oz.	14 oz.	13 oz.	12 oz.	11 oz.
Width.	LENGTH.	Extras in Cents per Pound for Sizes and Weights Other than Base.								
Not wider than 30 ins.	Not longer than 72 inches.	Base	Base	Base	Base	½	1	1½	2	2½
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	½	1	2	3	4½
	Longer than 96 inches. Not longer than 120 inches.	"	"	½	1	2	3	5	7	
	Longer than 120 ins.	"	"	1	1½					
Wider than 30 ins. but not wider than 36 inches.	Not longer than 72 inches.	"	"	Base	Base	1	2	3	4	6
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	1	2	4	6	8
	Longer than 96 inches. Not longer than 120 inches.	"	"	1	2	3	4			
	Longer than 120 inches.	"	1	2	3					
Wider than 36 ins. but not wider than 48 inches.	Not longer than 72 inches.	"	Base	1	2	3	4	6	8	9
	Longer than 72 inches. Not longer than 96 inches.	"	"	1	3	4	5	7	9	
	Longer than 96 inches. Not longer than 120 inches.	"	"	2	4	6	9			
	Longer than 120 inches.	"	1	3	6					
Wider than 48 ins. but not wider than 60 inches.	Not longer than 72 inches.	"	Base	1	3	5	7	9	11	
	Longer than 72 inches. Not longer than 96 inches.	"	"	2	4	7	10			
	Longer than 96 inches. Not longer than 120 inches.	"	1	3	6					
	Longer than 120 inches.	1	2	4	8					
Wider than 60 ins. but not wider than 72 ins.	Not longer than 96 inches.	Base	1	3	8					
	Longer than 96 inches. Not longer than 120 inches.	"	2	5	10					
	Longer than 120 inches.	1	3	8						
Wider than 72 ins. but not wider than 108 ins.	Not longer than 96 inches.	1	3	6						
	Longer than 96 inches. Not longer than 120 inches.	2	4	7						
	Longer than 120 inches.	3	5	9						
Wider than 108 ins., but not wider than 120 ins.	Not longer than 120 inches.	4	6							

The longest dimension in any sheet shall be considered at its length.

CIRCLES, 8 IN. DIAMETER AND LARGER, SEGMENTS AND PATTERN SHEETS, advance per pound over prices of Sheet Copper required to cut them from .... 3c.

CIRCLES LESS THAN 8 IN. DIAMETER, advance per pound over prices of Sheet Copper required to cut them from .... 5c.

COLD OR HARD ROLLED COPPER, 14 oz. per square foot and heavier, advance per pound over foregoing prices .... 1c.

COLD OR HARD ROLLED COPPER, lighter than 14 oz. per square foot, advance per pound over foregoing prices .... 2c.

COLD ROLLED ANNEALED COPPER, the same price as Cold Rolled Copper.

ALL POLISHED COPPER, 20 in. wide and under, advance per square foot over the price of Cold Rolled Copper .... 1c.

ALL POLISHED COPPER, over 20 in. wide, advance per square foot over the price of Cold Rolled Copper .... 2c.

For Polishing both sides, double the above price.

The Polishing extra for Circles and Segments to be charged on the full size of the sheet from which they are cut.

COLD ROLLED COPPER, prepared suitable for polishing, same prices and extras as Polished Copper.

ALL PLANISHED COPPER, advance per square foot over the prices for Polished Coppur .... 1c.

ZINC—Duty, sheet, 15%.	Cents per lb.
Carload lots, standard sizes and gauges, at mill	7.25 less 8%
Casks, jobbers' prices	8c.
Open casks, jobbers' prices	8½c.

Metal Prices, December 8, 1913

PRICES ON BRASS MATERIAL—MILL SHIPMENTS.

In effect December 1, 1913, and until further notice.

To customers who buy over 5,000 lbs. per year.

	Net base per lb.		
	High Brass.	Low Brass.	Bronze.
Sheet	$0.14¾	$0.16⅝	$0.18
Wire	.14½	.16⅝	.18
Rod	.14½	.17⅜	.19
Brazed tubing	.19¼	——	.22¾
Open seam tubing	.19¼	——	.22¾
Angles and channels, plain	.19¼	——	.22¾

50% discount from all extras as shown in American Brass Manufacturers' Price List No. 9.

NET EXTRAS FOR QUALITY.

Sheet—Extra spring, drawing and spinning brass.... ½c. per lb. net advance
" —Best spring, drawing and spinning brass.... 1½c. " " " "
Wire—Extra spring and brazing wire.............. ½c. " " " "
" —Best spring and brazing wire............... 1c. " " " "

To customers who buy over 5,000 lbs. per year.

	Net base per lb.		
	High Brass.	Low Brass.	Bronze.
Sheet	$0.16	$0.17⅞	$0.19¼
Wire	.15¾	.17⅞	.19¼
Rod	.15¾	.18⅝	.20¼
Brazed tubing	.20½	——	.24
Open seam tubing	.20½	——	.24
Angles and channels, plain	.20½	——	.24

Net extras as shown in American Brass Manufacturers' Price List No. 9.

NET EXTRAS FOR QUALITY.

Sheet—Extra spring, drawing and spinning brass.... ½c. per lb. net advance
" —Best spring, drawing and spinning brass.... 1½c. " " " "
Wire—Extra spring and brazing wire.............. ½c. " " " "
" —Best spring and brazing wire............... 1c. " " " "

BARE COPPER WIRE—CARLOAD LOTS.

18c. per lb. base.

SOLDERING COPPERS.

300 lbs. and over in one order.......................... 20½c. per lb. base
100 lbs. to 300 lbs. in one order........................ 21c. " " "
Less than 100 lbs. in one order.......................... 22½c. " " "

PRICES FOR SEAMLESS BRASS TUBING.

From 1¼ to 3½ O. D. Nos. 4 to 13 Stubs' Gauge, 19½c. per lb.
Seamless Copper Tubing, 23c. per lb.

For other sizes see Manufacturers' List.

PRICES FOR SEAMLESS BRASS TUBING Iron Pipe Sizes.

Iron pipe sizes with price per pound.

⅛	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6
27½	26½	21½	20½	19½	19½	19½	19½	19½	19½	19½	20½	21½	23½	25½	26½

PRICE LIST OF IRON LINED TUBING—NOT POLISHED.

	Per 100 feet	
	Brass.	Bronze.
⅜ inch	$8	$9
½ inch	8	9
⅝ inch	10	11
¾ inch	12	13
⅞ inch	14	15
1 inch	18	20
1⅛ inch	22	24
1¼ inch	25	27
1½ inch	32	35
1¾ inch	45	48
2 inch	56	69

Discount 50—5%.

PRICE FOR TOBIN BRONZE AND MUNTZ METAL.

Tobin Bronze Rod.. 18c. net base
Muntz or Yellow Metal Sheathing (14" x 48") .... 15c. " "
" " " Rectangular sheets other than Sheathing 17½c. " "
" " " Rod .... 15c. " "

Above are for 100 lbs. or more in one order.

PLATERS' METALS.

Platers' bar in the rough, 24½c. net.

German silver platers' bars dependent on the percentage of nickel, quantity and general character of the order.

Platers' metal, so called, is very thin metal not made by the larger mills and for which prices are quoted on application to the manufacturers.

PRICES FOR SHEET BLOCK TIN AND BRITANNIA METAL.

Sheet Block Tin.—Not over 18 in. in width or thinner than No. 26 B. S. Gauge, 5c. above price of pig tin in same quantity. Prices of greater width and thinner gauges on request.

No. 1 Britannia Metal.—Not over 18 in. in width or thinner than No. 26 B. & S. Gauge, 2c. above price of pig tin in same quantity. Prices of greater width and thinner gauges on request.

PRICE SHEET FOR SHEET ALUMINUM—B. & S. Gauge.

Gauge.	Width. Inches.	1 ton.	500 lbs.	50 lbs.	Less than 50 lbs.
20 and heavier	3-30	33c.	34c.	36c.	38c.
21 to 24 inclusive	3-30	34c.	35c.	37c.	39c.
	30-48	36c.	37c.	39c.	41c.
	48-60	39c.	40c.	42c.	44c.
25 and 26	3-30	35c.	36c.	38c.	40c.
	30-48	37c.	38c.	40c.	42c.
27	3-30	36c.	37c.	39c.	41c.
	30-48	39c.	40c.	42c.	44c.
28	3-30	37c.	38c.	40c.	42c.
	30-48	40c.	41c.	43c.	45c.
29	3-30	38c.	39c.	41c.	43c.
	30-48	42c.	43c.	45c.	47c.
30	3-30	39c.	40c.	42c.	44c.

The above prices refer to lengths between 2 and 8 feet. Prices furnished by the manufacturers for wider and narrower sheet. Charges made for boxing. F. O. B. Mill.

PRICE LIST SEAMLESS ALUMINUM TUBING.

STUBS' GAUGE THE STANDARD. SIZES CARRIED IN STOCK.
Outside Diameters. BASE PRICE, 24 Cents per Pound.

Stubs' Gauge.	Inches.	¼ in.	5-16 in.	⅜ in.	½ in.	⅝ in.	¾ in.	⅞ in.	1 in.	1¼ in.	1½ in.	1¾ in.	2 ins.	2½ ins.	3 ins.	3½ ins.	4 ins.	4½ ins.
11.	.120.	..	..	..	..	..	..	..	26	23	..	..	13	19	9	8	15	22
12.	.109.	..	..	..	..	..	..	..	25	..	..	..	14	..	..	..	..	..
14.	.083.	..	..	..	..	..	..	..	..	..	..	..	16	..	..	..	..	..
16.	.065.	..	..	..	..	27	26		26	22	22	20	20	20	20	26	30	36
18.	.049.	..	..	..	32	29	28		27	24	25	25	25	..	..	..	..	..
20.	.035.	116	..	45	38	33	32	31	29	28	29	29	29	30	37	48	57	80
21.	.032.	..	..	..	39	..	..	..	..	..	..	..	..	..	..	..	..	..
22.	.028.	137	97	47	41	37	36	34	33	..	..	44	..	..	..	..	..	..
24.	.022.	187	132	107	87	78	72	61	59	65	..	..	..	..	..	..	..	..

Prices are for ten or more pounds at one time. For prices on sizes not carried in stock send for Manufacturers' List.

PRICE LIST FOR ALUMINUM ROD AND WIRE.

Diameter. B. & S. G'ge	000 to No. 10.	No. 11.	No. 12.	No. 13.	No. 14.	No. 15.	No. 16.	No. 17.	No. 18.	No. 19.	No. 20.	No. 21.	No. 22.
Price per lb....	33	33¼	33½	34	34½	35	35½	36	37	38	39	44	47

PRICE LIST FOR GERMAN SILVER IN SHEETS AND ROLLS.

Per cent.	Price per lb.	Per cent.	Price per lb.
12	$0.52	16	$0.58
13	.53	17	.59
14	.54	18	.60
15	.55		

These prices are for sheets and rolls over 2 inches in width, to and including 8 inches in width and to No. 20, inclusive. American or Brown & Sharpe's Gauge. Prices are for 100 lbs. or more of one size and gauge in one order. Discount 50%.

GERMAN SILVER TUBING.

4 per cent. to No. 19, B. & S. Gauge, inclusive........................ $0.60
6 " " 19, " " " .... .70
9 " " 19, " " " .... .85
12 " " 19, " " " 1.00
15 " " 19, " " " 1.15
16 " " 19, " " " 1.20
18 " " 19, " " " 1.30

German Silver Tubing thinner than No. 19 B. & S. Gauge add same advances as for Brazed Brass Tube.

For cutting to special lengths add same advances as for Brazed Brass Tube. Discount 40%.

PRICES OF SHEET SILVER.

Rolled sterling silver .925 fine is sold according to gauge quantity and market conditions. No fixed quotations can be given, as prices range from 1c. below to 4c. above the price of bullion.

Rolled silver anodes .999 fine are quoted at 2½c. to 3¼c. above the price of bullion.

INDEX NUMBER

Chem

VOL. 11. NO. 12

Registered in U. S. Patent Office

DECEMBER, 1913

THE METAL INDUSTRY

WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD, THE BRASS FOUNDER AND FINISHER
ELECTRO-PLATERS REVIEW AND COPPER AND BRASS

$1.00 Per Year | 99 JOHN STREET, NEW YORK | 10 Cents Per Copy

A TRADE JOURNAL RELATING TO BRASS, COPPER, TIN, LEAD, ZINC, ALUMINUM, NICKEL, SILVER, GOLD, BRONZE

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PAXSON LININGS FOR

Cupolas, Stacks, Furnaces *and* Ladles

9 Inch Straight . .

Split 1¼-1½x2 in.

Soap . . . . . .

No. 1 Key . . .
12 feet diameter inside.
112 brick to circle.

No. 2 Key . .
6 feet diameter inside.
65 brick to circle.

No. 1 Wedge . .
5 feet diameter inside.
102 brick to circle.

No. 2 Wedge . .
2 feet 6 inches diameter inside.
6 brick to circle.

No. 1 Arch . . .
4 feet diameter inside.
72 brick to circle.

No. 2 Arch . . .
2 feet diameter inside.
42 brick to circle.

24 Inch Circle Brick
Inside diameter.
11 brick to circle.

36 Inch Circle Brick
Inside diameter.
14 brick to circle.

48 Inch Circle Brick
Inside diameter.
20 brick to circle.

60 Inch Circle Brick
Inside diameter.
25 brick to circle.
72 in. Inside diam. Circle brick
84 in. Inside diam. Circle brick

No. 1 Cupola Block
Diameter { 42 inches outside. 30 inches inside.
15 brick to the circle.

No. 2 Cupola Block
Diameter { 48 inches outside. 36 inches inside.
17 brick to the circle.

No. 3 Cupola Block
Diameter { 60 inches outside. 48 inches inside.
21 brick to the circle.

No. 4 Cupola Block
Diameter { 72 inches outside. 60 inches inside.
25 brick to the circle.

No. 5 Cupola Block
Diameter { 84 inches outside. 72 inches inside.
29 brick to the circle.

During the Holidays many Foundries do their re-lining.
We carry a large stock in Phila. as well as at the factory and can ship at a moment's notice.

SEND US YOUR ORDERS OR SPECIFICATIONS.

J. W. PAXSON CO.
MANUFACTURERS

1021 N. Delaware Ave.
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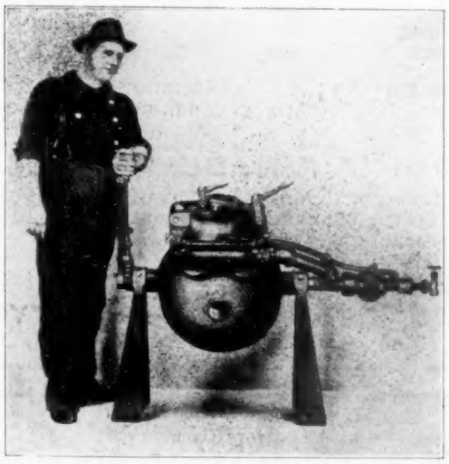
SAVE TIME and MONEY!



No. ½ Hawley-Schwartz Metal Furnace

100 Lbs. Capacity

For a limited time only we will offer this furnace complete, lined with our special refractory lining, with suitable blower and oil pump for $250.00.

No crucibles to eat up profit. No coke or ashes to bother with. 600 to 1000 heats to a lining, compared to a few with a crucible.

New Lining, $10 *Write to-day*

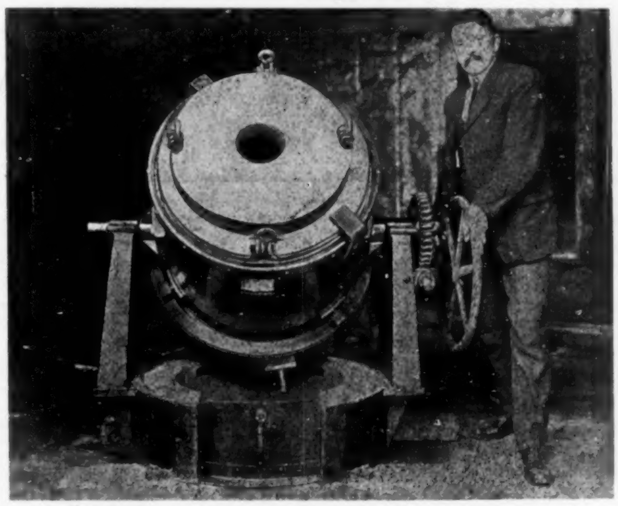
The Hawley Down Draft Furnace Co.
Easton, Pa. Dept. A

FOUNDERS!

AN "IDEAL" COKE FIRED CRUCIBLE FURNACE.

placed in competition with any or all other makes of Brass Melting Furnaces, will demonstrate that the "IDEAL" is the one for you to install.

We invite a competitive trial.



No. 125 and No. 150 Furnaces are all above the floor and have drop grate.

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IDEAL FURNACE CO., Chester, Penna.

The Brand of Quality

ROSS-TACONY CRUCIBLE CO.

[Size Number]

TACONY

PHILADELPHIA, PA.

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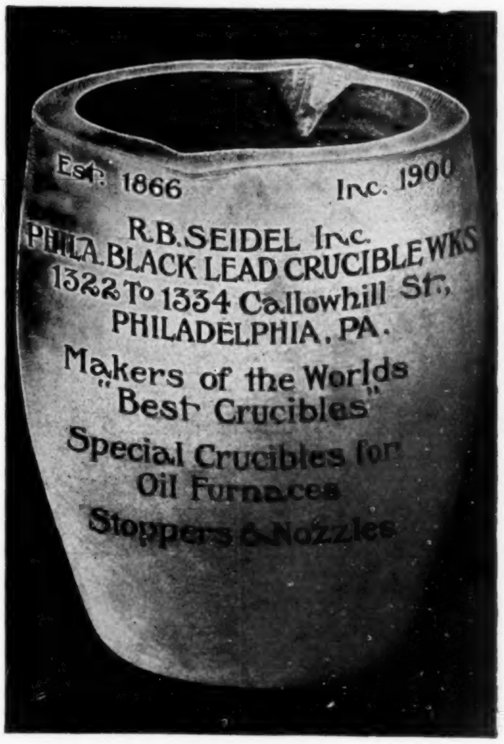
JONATHAN BARTLEY CRUCIBLE CO.
Trenton, N. J., U. S. A.



THE REAL SAND BLAST BARREL

If you have small castings, either plain or cored work, to sand blast, there is no better method than by the use of our modern sand blast barrel, as shown in cut herewith. The barrel is made in four sizes, in accordance with quantity of work you have to tumble, and substantially built.

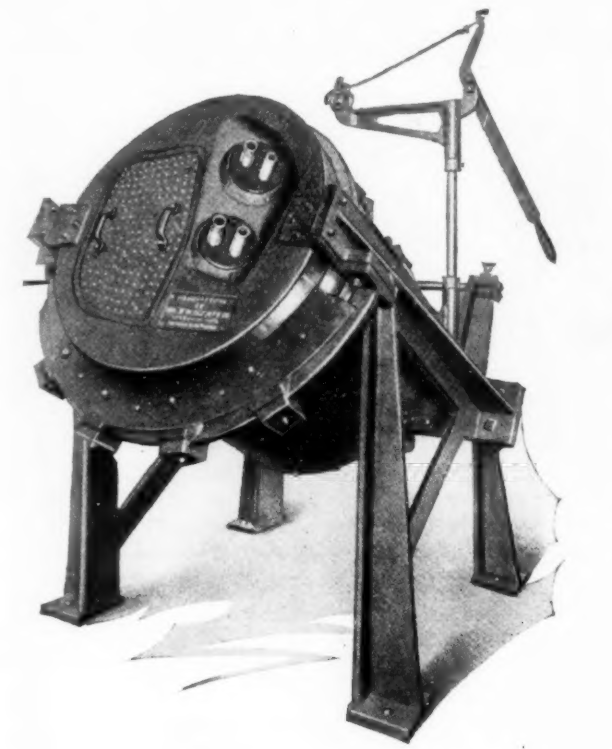
The sand is cleaned automatically and returned to the sand blast barrel ready for re-use. There is an easy method in loading and unloading the barrel. In fact, the entire operation requires considerably less horse power and time than the average method of sand blast.

Explain your proposition to us, and we will save you time and money. We make complete sand blast room outfits.

We want you to learn that

"SLY and SATISFACTION"

are synonymous.



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CLEVELAND, OHIO

Designers and Builders of Foundry Equipment with an ESTABLISHED REPUTATION

Catalog "M" sent on request.

HYDRAULIC TOOLS

All Kinds - All Sizes - Best Quality

Accumulators.
Benders, pipe, rail, tube.
Bulldozers; Couplings, flange.
Cranes; Fittings; Gauges; Intensifiers; Jacks, ball bearing, bridge, car, pit, car journal, locomotive, piston rod, pulling, pumping, ratchet, screw, shoring, traversing, wrecking.
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Pumps; Punches, beam, bell, bench, rail bond, hand portable, rail, screw, steel tie, tie plate.
Riveters, portable, car coupler.
Shears, car coupler.
Valves, check, float, flushing, regulating, relief and tank.

Write for catalogs, quotations, and the advice of our engineers. We will gladly co-operate with you.

W-S HYDRAULIC

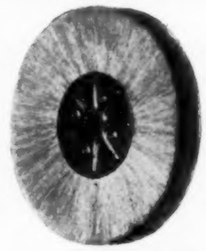
THE WATSON-STILLMAN CO.

Engineers and Builders of Hydraulic Tools

196 Fulton St. New York

145

Ask About Osborn Tampico Wheel Brushes



THERE'S a quality-difference in Tampico Wheels that makes a difference in the cost-to-you of the work they do in a given month or year.

Be sure that the difference will be in your favor — by learning about Osborn Tampico Wheels, made by wheel-brush specialists. Heavier than wire-drawn or knot brushes, full and compact, fast-cutting, long-lasting, cheapest in the end.

OSBORN

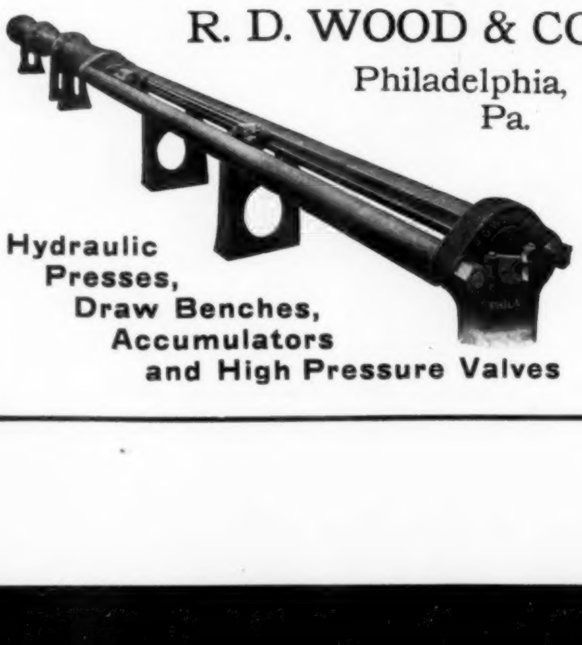
Ask us for information about them.

THE OSBORN MANUFACTURING CO.

Cleveland	Milwaukee	New York	San Francisco
5401 Hamilton Ave.	348 Florida St.	204 Centre St.	61 First St.

R. D. WOOD & CO.

Philadelphia, Pa.



Hydraulic Presses, Draw Benches, Accumulators and High Pressure Valves

The Original Shop Pyrometer

A new 64-page catalog of the Wm. H. Bristol Electric Pyrometers has just been issued, on page 3 of which a list of Bristol Pyrometer Patents is printed, giving the dates of the patents on

Bristol Thermo-Electric Couples

and other exclusive features. At the time the Bristol Electric Pyrometer was put on the market and several of these patents issued this was the only thermo-electric pyrometer equipped with pivot jewel bearing instrument and base metal alloy couples that was adopted for extensive use under shop conditions or in industrial works. The fact that this original shop pyrometer has proved successful in long continued service is evidenced by the fact that this new catalog contains a partial list of users including names of more than 1,400 customers.

Write for this new 64-page 8 x 10½" catalog, 1400-C.

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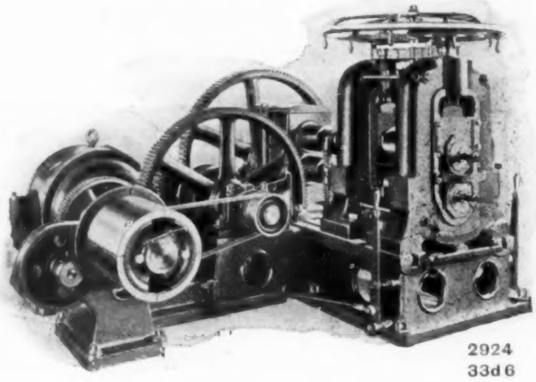
Branch Offices: New York, Pittsburg, Chicago



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enjoys a world-wide reputation, due to its practical and scientifically correct design, the high grade of material used and the excellent accurate workmanship in every part. Cold Rolling Machines for any metal. Also all auxiliary machines needed in the Cold Rolling process. Quotation on any single machine, as well as complete mill equipments. Catalog C upon request.

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(The Pittsburgh Foundry, ESTABLISHED 1803)

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One of our largest departments is devoted to Chilled Rolls. We make Chilled Rolls weighing 37½ lbs. for rolling gold and silver and Chilled Rolls weighing 70,900 lbs. for rolling steel plate. The first Chilled Rolls made in America were made by us and we have made a specialty of Rolls and Rolling Mill machinery ever since; for one customer in particular, of more than National prominence, we have made Chilled Rolls continuously since 1843.

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"Metal Spinning Lathes and Accessories for round and oval work. Face Plate Chucks, Thread Casting Jigs, Ball Bearing Back Centers, etc. Complete line of Spinners' Tools always on hand. Spinning Lathes from 12" to 44" Swing.

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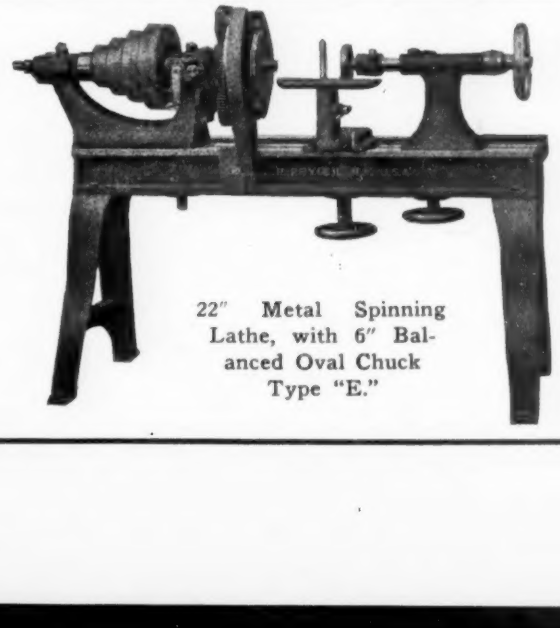

22" Metal Spinning Lathe, with 6" Balanced Oval Chuck Type "E."

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MONTH	AMERICAN EDITION	DIRECTORY EDITION	ENGLISH EDITION
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February	6,000	-----	2,000
March	6,025	-----	2,000
April	6,025	-----	2,000
May	6,025	-----	2,000
June	6,025	-----	2,000
July	5,725	-----	2,000
August	5,725	-----	2,000
September	5,725	-----	2,000
October	6,525	-----	2,000
November	6,275	-----	2,000
December	6,275	-----	2,000
	76,350	8,000	24,000

Total Copies Printed --- American Edition ----- 76,350
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Monthly Average -------- American, English and Directory Editions --- 9,029 Copies.

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THE METAL INDUSTRY.
Palmer H. Langdon PUBLISHER

Palmer H. Langdon being duly sworn deposes and says:
That he is the Publisher of THE METAL INDUSTRY and swears that the foregoing statement is true and correct.

Sworn to before me this 4th day of December 1913.

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NOTARY PUBLIC, KINGS COUNTY,
CERTIFICATE FILED IN NEW YORK COUNTY,
AND U. S. CUSTOM HOUSE, N Y

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BALL BEARING LATHES

Our No. 7 Ball Bearing Lathe is dust-proof and mechanically perfect. It has two ball races on each side, or four in all, which are self aligning. Crucible machine steel shaft. Square cut thread. Weight, 400 lbs. Write for Circular M.

Reliance Motor Lathes are also ball bearing. Motor self-contained, Variable Speed, for direct current only.

Reliance Dynamos, two or three-wire system, single or double commutator. Self-Lubricating Brushes, Slow Speed.

Reliance Canvas Wheels.

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Office and Factory:

26-30 So. Clinton St. Chicago, Ill.

This Hood Is Unequalled for Simplicity

No Side Doors.
No Loose Slides.
Firm, Strong, Durable.
Adjustable to Any Wheel

The only hood that protects the workman from rheumatism as there is no sharp suction at point of wheel where his body is closest.

The Northern Blower Co.

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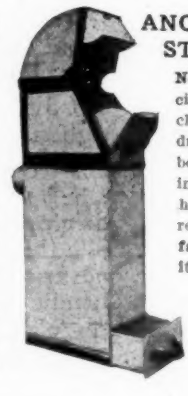
Complete Dust Collecting Systems. Special Systems for Pattern Shops.



ANOTHER STYLE

Note especially the clean-out drawer at bottom into which heavy refuse falls before it can reach fans or piping.

PEERLESS POLISHING WHEEL

(Sectional View)

A rim of pieces of leather set edgewise on a center of wood and held firmly by a metallic band on which they are strung. A very durable wheel for medium and heavy work. Not affected by atmospheric changes.

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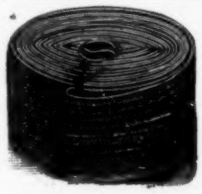

AMES SWORD COMPANY
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Manufacturers of

ENDLESS SEWED POLISHING BELTS

Correspondence Solicited *Discounts Quoted*

THE AYER MFG. CO.

Manufacturers of

All grades of polishing and buffing compositions.
Samples submitted free of charge, on request.

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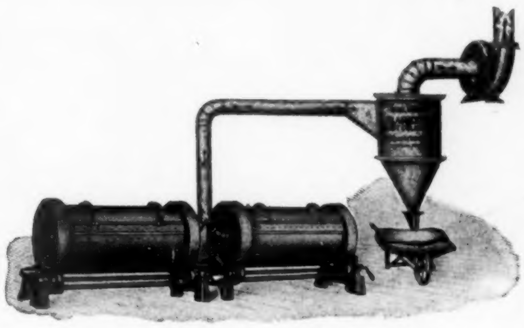
THE MORSE "RAREFIED" DUST COLLECTOR

OPERATES ON THE PARTIAL VACUUM PRINCIPLE



OFFERS THE CHEAPEST AND BEST SOLUTION OF YOUR DUST TROUBLES
WITH EMERY WHEELS, POLISHERS, TUMBLING MILLS OR SAND BLASTS

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SCIENTIFIC MANAGEMENT demands lower cost with increased output.

STATE LAW demands clean shop with healthier conditions.

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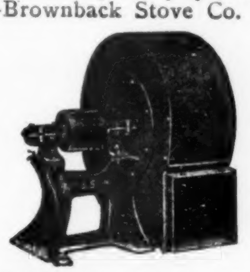
Write us. Estimates free. Guaranteed results.

Gentlemen: May 27, '13.
We are pleased to advise the exhaust system for our Polishing Department was completed this afternoon, and after making a thorough inspection, we find everything in apparent good order and running smoothly.
Very truly yours,
March-Brownback Stove Co.

Write for Catalogue D. C. S.



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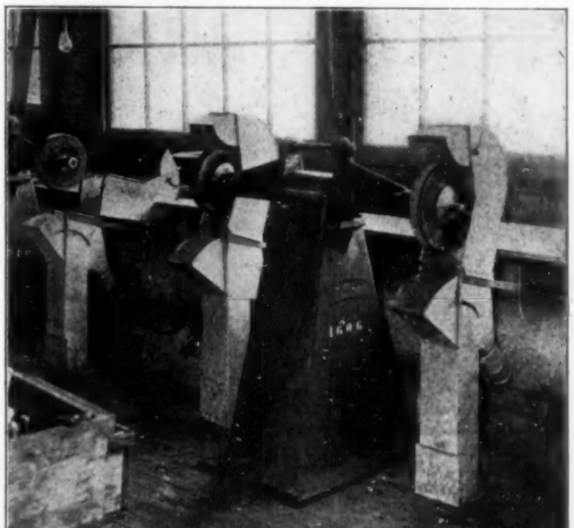
2096 W. Third Street, Cleveland, Ohio



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We are anxious to show you the production value of these hoods and what they are doing for others. We are willing to send one on trial to be returned at our expense if not satisfactory. State height of center of spindle from floor and diameter of largest wheel used.
We furnish plans, specifications and estimates for complete systems without charge.

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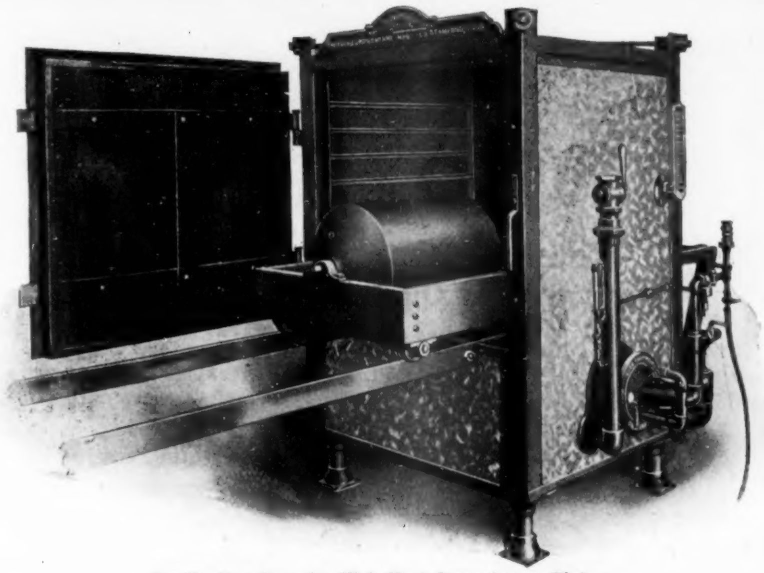
THE CRAWFORD SECTIONAL OVEN
PAT'D NOV. 20, 1906
THE OVEN EQUIPMENT AND MFG. CO. NEW HAVEN, CONN.



Combination Oven for High Heat Japanning or Bluing.

Thorough Circulation

is the big requirement for clean, bright work in japanning and baking lacquer. It is needed to move the fumes from the surface of the work. It's absent from the ordinary oven.

But it's one of the main features of

CRAWFORD Sectional Ovens

And it's made positive by the blower which delivers superheated air into the oven through the

Enclosed Flame Gas Burner

Send today for illustrated folder and our catalog 997.

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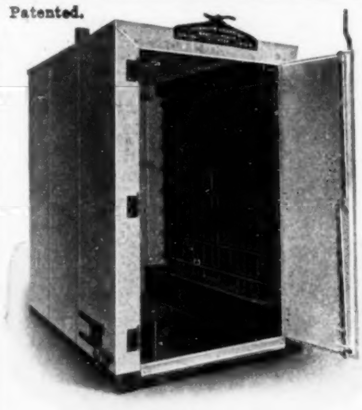
Patented.



THE GEHNRICH INDIRECT HEAT RADIATOR OVEN

Approved by the Board of Fire Underwriters

The greatest advance yet made in oven construction

USED FOR JAPANNING, LACQUERING ENAMELING. OTHER OVENS FOR CORE BAKING, DRYING, TEMPERING, SHERARDIZING.

Send for Catalog "TMI"

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The Steiner Sectional Portable Ovens

Designed to meet special conditions. Heated by gas and adaptable for many lines of manufacture. Used for Japanning, Enameling, Baking and Drying. Has many superior advantages.

DRYING OUT BOXES

Fitted with steam coils or gas burners where steam is not available. Send for Catalogue "M."

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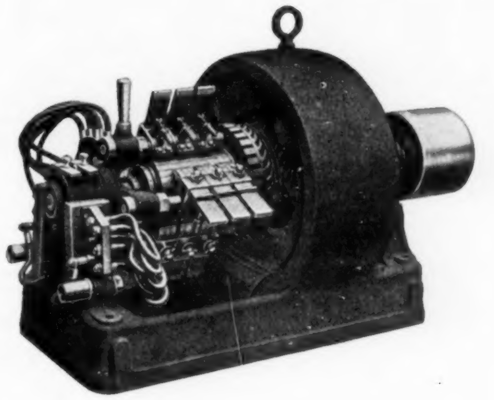

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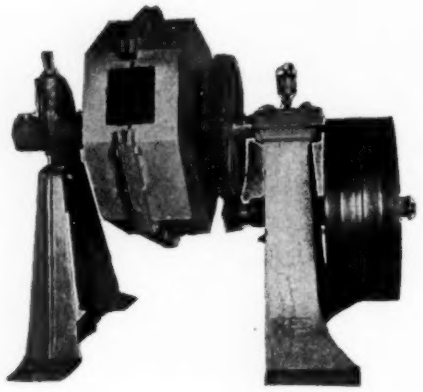
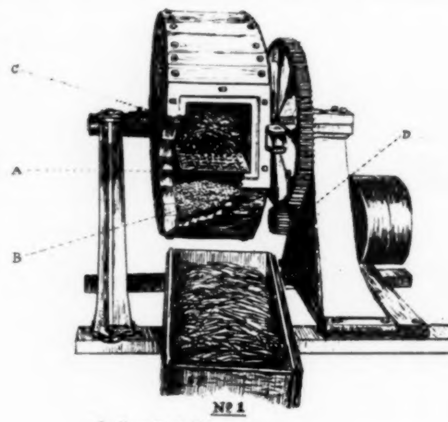
Contractors to H. M. Government and other Governments, Railways, etc. Established 1785



Roughing and Fining Barrel



No 1

A. Screen in Position.
B. Balls on lower side of barrel, seperated from material
C. Material —— burnished ready to remove.
D. Ajustable pinion

Oiling, Coloring and Buffing Barrel

Our Screening arrangement saves picking the work from the burnishing balls and replacing the balls in barrel. In our barrel the balls and solution drop through the screen, leaving the work accessible.

You haven't installed a system, perhaps for the reason you doubted your work could be done by it. You send us samples, we will process them and return them to you, with our recommendations.

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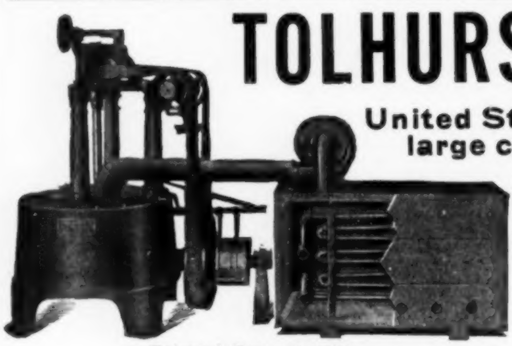
Drying Metal Goods In Sawdust is a Thing of the Past

TOLHURST METAL DRYER and BRIGHTENER



United States Mints and many large concerns use them

No sawdust required

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EUROPEAN REPRESENTATIVE—Ernst Bernheim, Ludw. Loewe-Haus, Düsseldorf, Germany.

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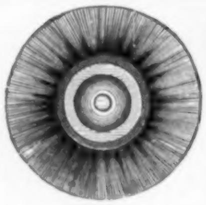
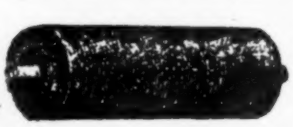


We manufacture all kinds of brushes for



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Circular, Brass, Steel, and Satin Finish Wire Brushes our Specialty.

Samples sent on request.

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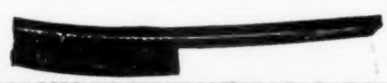
Brass, Copper and Steel Wire Brushes
An assortment of Machine and Circular Brushes.—
Chandelier Manufacturers', Silver and Nickelplater's Brushes, etc.

Repairs Promptly Attended to.



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Manufacturers

241-243-245 CENTRE ST., NEW YORK

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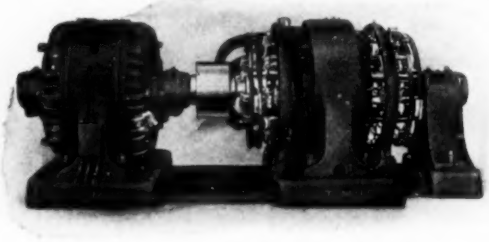
BUY WORDS in the Electro-Plating Industry

"OPTIMUS"
"TRIPLEX"
"NONE SUCH"



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Munning-Loeb Company

MATAWAN, N. J.

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LATHES "NONE-SUCH" ROTATING PLATING MACHINES SALTS ROUGES TANKS WHEELS

26

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VIENNA LIME
COMPOSITIONS
ARE
UNEQUALED

Tripoli, Rouge, Emery
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Labor, Space and Power are all conserved. Result: Greatest quantity and highest quality of finished product.

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FULTON AND ELIZABETH STREETS

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Royal Prepared
Nickel Salts

GIVE A BRIGHT, HOMOGENEOUS DEPOSIT IN

ONE THIRD THE USUAL TIME

BUFFING IS PRACTICALLY ELIMINATED
ABSOLUTE SATISFACTION IS GUARANTEED

Zeus for all metals, gives a permanent non-porous, and brilliant deposit of any required thickness.

Barrelplate a similar salt to Zeus, without question the best salt for mechanical plating.

Argenta this salt gives the particularly hard deposit required on cutlery and iron or steel which must be ground.

Specially Prepared Double Copper Salts
Specially Prepared Double Brass Salts
Specially Prepared Black Nickel Salts

These salts eliminate the uncertainty experienced in making up and maintaining brass, copper and black nickel baths. The results obtained will be a revelation both as to rapidity and quality of work.

"Royal Verelfa" Galvanizers Soap and Salve
An absolute cure for Galvanizers Eczema.

Royal Phosphor Copper, 10 and 15% phosphorus guaranteed, for deoxidation of non-ferrous metals, and phosphor bronze.

Royal Manganese Copper, unequalled for making manganese bronze, 30% manganese

Royal Silicon Copper, for yellow brass, and pure copper castings, 10, 20 and 30%.

Royal Phosphor Tin, unconditional guarantee of purity, 5% phosphorus, 95% pure tin.

Ferrool Hockait, a genuine hard solder for cast iron. Try it and be convinced.

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All our materials are analyzed before being placed on sale and we **personally guarantee** every article to be of the exact quality specified.

We Have A Large Stock—Every Chemical the Plater and Manufacturer Needs.

Mark in the blank space the approximate quantities you will use during 1914, send us the list and we will submit attractive quotations.

Apothecaries Hall Co.

INCORPORATED 1849

18 Benedict St. Waterbury, Conn.

FILL OUT, TEAR OFF AND MAIL TO

APOTHECARIES HALL CO.

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Please quote us contracts for 1914 as follows:

MATERIAL	ESTIMATED REQUIREMENTS
Potassium Cyanide 96%	
Sodium " 128—130%	
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Fused "	
Nickel Salts, Double	
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Aqua Ammonia 26°	
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" " Liquid	
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Name..

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EXCEL-ALL Dynamos are a step in advance. They are higher in efficiency. SIMPLER to operate and require LESS ATTENTION.

Built in Sizes 75 to 4000 Amperes.
Single or double voltage.
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Constant Voltage at any load.
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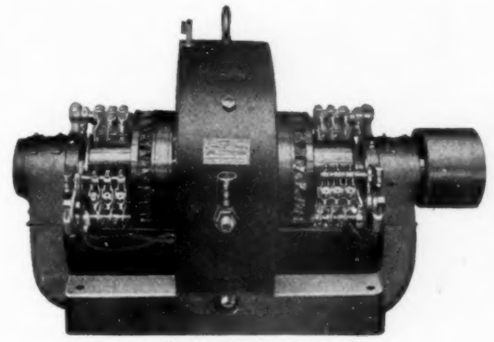
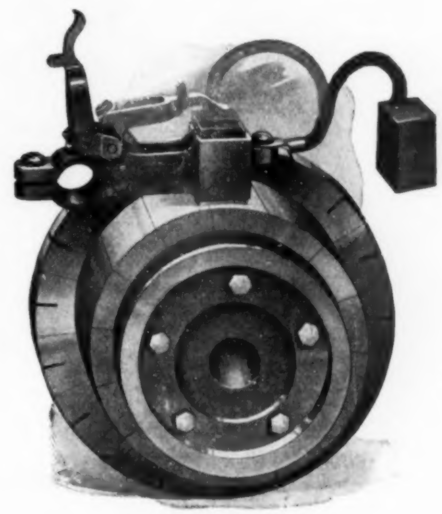


1500 AMPERE 6 VOLT.



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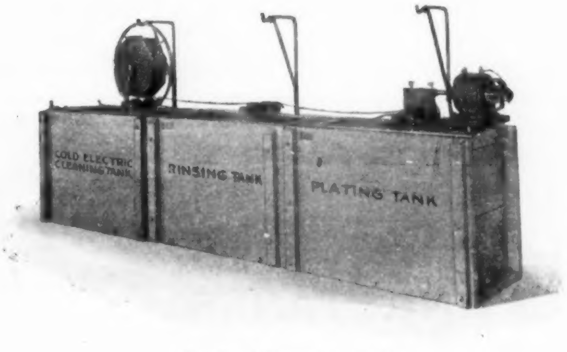

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DID YOU SEE OUR EXHIBIT AT FOUNDRY AND MACHINE EXHIBITION AT CHICAGO?
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UNITED STATES PATENTS JUNE 22, 1897—FEB. 24, 1903—OCT. 11, 1904—MARCH 24, 1908—MAY 19, 1908.

CANADIAN PATENTS NOS. 58,205 AND 97,852.
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In many instances eliminates the necessity of buffing after plating

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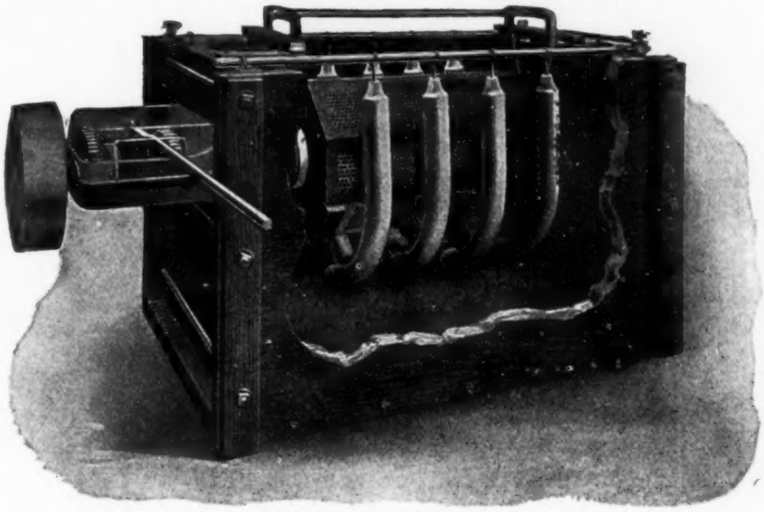
Arrange for an appointment to see one or more batches of your work put through.

WRITE FOR BULLETIN 113
THIS TELLS ALL ABOUT THEM



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NEVER requires additions of any kind.

The "STANDARD" Solution ALWAYS works at its best, day in, day out, without requiring the least attention.

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ALWAYS ON THE JOB.

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"PERSELS"
(Reg. Trade Mark)
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For efficient cleaning.

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(Rapid automatic plating)
For low voltage mechanical plating.

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For rapid, brilliant electro galvanizing.

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THE ONLY SOLUTION ON THE MARKET THAT WILL DO IT.

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COPPER BEARING MATERIAL
A superior market offered for all kinds of Residue and Scrap Materials containing copper in any form
LEAD BEARING MATERIAL
Battery Plates, Sediment, Sulphates, Drosses, etc.
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Pig Tin, Pig Lead, Spelter
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Ingot Copper, Antimony, Bismuth
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Copper, Composition, Yellow **INGOT** Copper, Composition, Yellow
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because of its great deoxidizing property will improve your Castings.
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OFFER FOR SALE:
HEAVY COPPER AND WIRE, Ready for the Crucible
COMPOSITION, Carefully Selected
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OLD METALS GENERALLY

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Tell us your wants or send us your samples for analysis. We will quote you most attractive prices.
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Are the Original and Only Manufacturers of
AUTOMOBILE BRAND AERIAL BRAND
ALUMINUM CASTINGS
Our Aluminum Castings are Especially Adapted to Automobile, Auto Boat and Aerial Construction

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Brass and Bronze Castings
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Modern Machine Shop Automatic Screw Machines
Accurate and Interchangeable Work a Specialty
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NATIONAL SHEET METAL COMPANY
Manufacturers of
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Large Saving to Manufacturers
Last Year's Sales 1,500,000 lbs.
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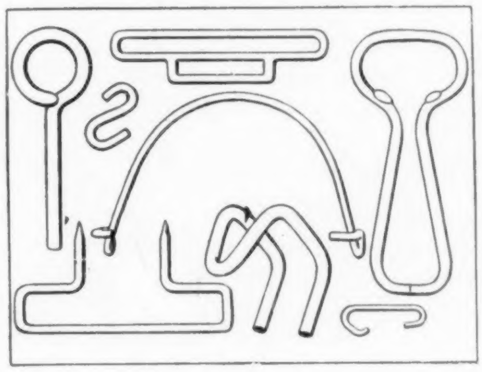

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The above articles were made automatically at a very low price. Let us figure on your requirements.

The Autoyre Co., Oakville, Conn. (Suburb of Waterbury)

BUCKLE TONGUES
made from any metal desired.
English style. The finest made.
Campbell-Warner Co., Middletown, Conn.

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PLATING and REFINISHING
We solicit the work of manufacturing concerns not equipped to do their own plating. We also manufacture small Metal Novelties. Write for prices

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METAL SPINNER
High-grade spinning in oval and round work. Sterling silver and gold rolled plate a specialty; also copper, brass, etc.
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FOR SALE AT A BARGAIN—6 Class A No. 3, 2,000 pound capacity, complete with operating mechanism, tracks, chains, sprockets, etc.; and 1 Class A No. 2, 500 pound capacity. These furnaces were made by the Hawley Down Draft Furnace Co., and are in good condition. They will be sold separately or as a lot, at attractive prices. Correspondence and inspection invited.

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FOR SALE—Complete 1-1 ton elevator platform 4½ ft. x 8 ft. 5 H. P. 220 volts, D. C. motor. Now equipped for 12-foot hoist and in operation.

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FOR SALE—Write us for prices on used machinery. We have in stock, lathes, drill presses, punch presses, shapers, spinning lathes, etc. Write us for full list and prices.

RICHMOND MANUFACTURING CO.,
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FOR SALE—Half price, five thousand Harbison-Walker Monroe brick, perfect condition. Good for bake oven or any place where high temperatures are not required.

QUAYLE ENAMEL COMPANY, ALBANY, N. Y.

FOR SALE—500 pounds of assorted steel balls for tumbling and burnishing. Will sell cheap. L. F. GRAMMES & SONS, Allentown, Pa.

FOR SALE—Casket Hardware Machinery. Tin tube machinery a specialty. Address MACHINERY, care THE METAL INDUSTRY.

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WANTED—To purchase a small chemical business, preferably in nitro-cellulose line. Address

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WANTED—Selling Agency for articles made of Brass, Bronze or kindred metals adapted for Hardware, Plumbing, Automobile or General Supply Houses. By a large concern with ample capital and unexcelled facilities for exploiting any article of merit.

METAL AGENCY, Care THE METAL INDUSTRY.

WANTED—Salesman, with a little capital, also experience in selling aluminum cooking utensils. I am a first-class metal spinner with some capital and wish to open a shop and have a partner to sell the goods. Address SPINNER, care THE METAL INDUSTRY.

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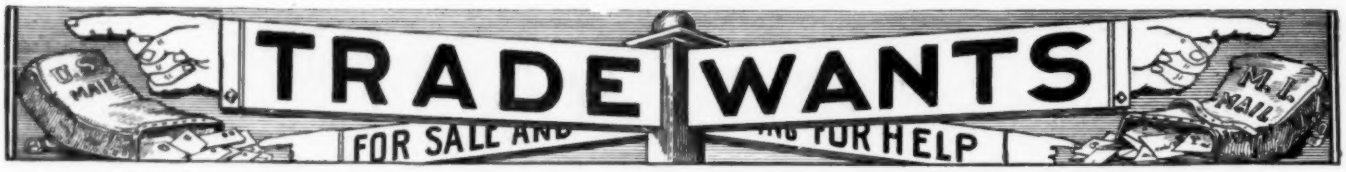
WANTED—Second-hand, heavy single rotary slitting shear, also Rod Rolling Mills.

ROTARY, Care THE METAL INDUSTRY.

WANTED—A second-hand U. S. Electro-Galvanizing Outfit. Address GALVANIZING OUTFIT, care THE METAL INDUSTRY.



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INQUIRIES

Inquiries received by The Metal Industry for Metals, Machinery and Supplies. Further particulars may be obtained by addressing the inquiry number, care The Metal Industry. No charge for inserting these inquiries.

Inquiry No. 736.—We wish to install an up-to-date plating plant and would like to have any information you can give us.

Inquiry No. 737—Where can we purchase an oven for annealing sheet aluminum?

Inquiry No. 738—Where is the best place to purchase circle shears?

Inquiry No. 739—Kindly advise where we can secure baling presses for packing scrap metal.

Inquiry No. 740—Who makes machines for grinding silver solder?

Inquiry No. 741—Where can I get prices on braided asbestos tubing, such as is used inside generator tubes on gasoline lamps?

Inquiry No. 742—We desire catalogues and prices of melting furnaces, tilting style.

Inquiry No. 743—Can you furnish the names of New York buyers who would be interested in galvanized wire netting of British manufacture?

Inquiry No. 744—We want to buy a small chemical business with good prospects. Preferably connected with the nitro-cellulose industry.

Inquiry No. 745—We desire information in regard to making bronze die castings in lots of 50,000.

Inquiry No. 746—Please advise where we can secure ⅜-inch diameter aluminum rods.

Inquiry No. 747—Where can I buy the foot power press described on page 442 of your October number?

Inquiry No. 748—We are in the market for die shop equipment and melting furnaces.

Inquiry No. 749—Kindly furnish me with the names of firms in the United States who could manufacture a new form of safety razor, stamped out of sheet brass or steel, and plated. Also wafer blades for these razors.

Inquiry No. 750—Can you tell us who manufactures carbonate of potash? We wish manufacturers' names, not dealers'.

Inquiry No. 751—Who manufactures the "W. V. D." metal atomizer?

Inquiry No. 752—Where can we secure duplex tin?

Inquiry No. 753—Please advise where Monel metal can be obtained.

Inquiry No. 754—Please give me the names of reliable firms which sell sterling silver, rolled gold plate, German silver, gilding metal, etc.

Inquiry No. 755—Can you tell me where iron and steel filings are bought?

Inquiry No. 756—Please send us the names of manufacturers of machinery for making wire solder.

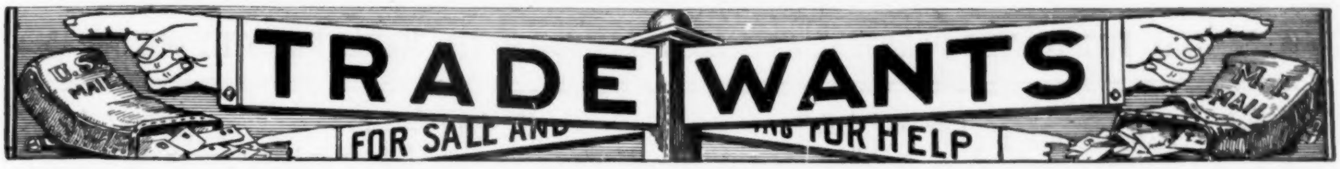
Inquiry No. 757—Where can we procure magnalium metal?

Inquiry No. 758—Please give us the names of Eastern concerns which make a specialty of metalizing non-metallic objects.

Inquiry No. 759—Who manufactures Retz alloy which we understand is composed of copper, tin, lead and antimony?

Inquiry No. 760—Can you inform me who makes an outfit that will supply a gas that will mix with air, to be used with blow pipe for soft and hard soldering on brass?

SITUATIONS OPEN



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Undisplayed Advertisements Under This Heading 50 Cents Each Insertion
Displayed Advertisements $1.50 per inch each insertion

EXECUTIVE

SITUATION WANTED—By young married man, sober, energetic, has the "making good" habit. Ten years' business and mechanical experience. Now executive in charge of factory making metal buttons and similar articles. Thoroughly familiar with press dies, tools and fixtures. Looking for broader opportunities. Address ENERGETIC, care THE METAL INDUSTRY.

TUBE MILL ENGINEER

SITUATION WANTED—By a German Mechanical Engineer and Constructor who has erected and conducted several plants in Germany for the manufacture of seamless copper and brass tubes. Salary to be moderate at start. Address GERMAN, care THE METAL INDUSTRY.

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SITUATION WANTED—CHEMIST and METALLURGIST, age 29, desires change. Experienced in the production of all non-ferrous alloys and physical testing. Expert analyst. Address "MET." care THE METAL INDUSTRY.

SITUATION WANTED—Analytical Chemist, College Graduate, with six months' experience in motor car laboratory, desires position. Small salary considered. References. Address ANALYTICAL CHEMIST, care THE METAL INDUSTRY.

SALESMEN

SITUATION WANTED—Salesman. A shop-bred salesman would like to work for a reliable concern. Have specialized in all aluminum products, both in shop experience and selling. Three years' experience. Best of references. Address ALUMINUM SALESMAN, care THE METAL INDUSTRY.

SITUATION WANTED—Practical man, experienced as salesman and demonstrator, would like to correspond with manufacturers of platers' and polishers' supplies, or chemical house. Would prefer to represent a manufacturer in New England States. Can furnish reference. Address PRACTICAL MAN, care THE METAL INDUSTRY.

SITUATION WANTED—By a salesman who is thoroughly experienced on manufactured brass and mill products. Have made good selling for one of the largest manufacturers and mills in Connecticut. Well established in Greater New York and New Jersey. Six years selling. Am seeking broader field. Address PRODUCER, care THE METAL INDUSTRY.

SITUATION WANTED—Salesman. A shop-bred salesman would like to connect with a responsible Metal Manufacturing Company as a Salesman or Sales Manager. Understands details of costs and has a wide acquaintance with buyers and particularly adapted to negotiate contracts. Can add $200,000 or more new business per year, depending on facilities. The best Commercial and Banking references. Address WM. H. FORSYTH, care THE METAL INDUSTRY.

OFFICE MAN

SITUATION WANTED—By a young man who has had six years' experience in the office of one of the largest brass and copper companies in the country. Thoroughly familiar with all branches and can give references. Have also had some selling experience. Address BRASS, care THE METAL INDUSTRY.

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SITUATION WANTED—Experienced Designer, Draughtsman, Illuminating Fixtures, catalogue illustrations, new ideas, well versed in classical periods, styles of ornamentation. Piece or short-time work employment. Address, J. L., care THE METAL INDUSTRY.

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SITUATION WANTED—By Expert LOST WAX and FRENCH SAND MOLDER for ornamental statuary, etc., work. Sixteen years' experience. Capable of taking charge of foundry. Address LOST WAX, care THE METAL INDUSTRY.

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SITUATION WANTED—Position as Brass Foundry Foreman, 25 years' experience; 10 years as foreman. Specialty shop preferred. Best of references. Address ALBERT F. BEARENS, 5 Olive avenue, Dubois, Pa.

FOUNDRYMEN—Continued

SITUATION WANTED—By a progressive, up-to-date BRASS FOUNDRY FOREMAN, 20 years' experience in all branches of the best foundry practice. Can keep down costs and increase production. Would like to hear from an up-to-date firm requiring the services of a Practical Foreman. First-class references can be furnished, and can accept a position on short notice. Address PROGRESSIVE, care THE METAL INDUSTRY.

SITUATION WANTED—As FOREMAN of BRASS FOUNDRY. Chicago preferred. Seventeen years' experience as foreman. Can furnish best of references. Address EXPERIENCED FOREMAN, care THE METAL INDUSTRY.

SITUATION WANTED—Brass Foundry Foreman, who is thoroughly familiar with all mixtures, would like to correspond with a firm who are in need of a first-class man. Can furnish references. Address J. F., care THE METAL INDUSTRY.

SITUATION WANTED—As BRASS CORE ROOM FOREMAN or ASSISTANT FOUNDRY FOREMAN. I am a first-class coremaker of 18 years' experience in brass core room, and can handle men or girls to the best advantage and produce first-class results. Address CORE ROOM FOREMAN, care THE METAL INDUSTRY.

SITUATION WANTED—As Brass Foundry Superintendent or Foreman. Thoroughly familiar with all metals and can furnish good references. At present employed, but desire to change my position. Address D. R. W., care THE METAL INDUSTRY.

SITUATION WANTED—By a Brass Foundry Foreman, who is desirous of corresponding with Eastern Foundries who have an opening for a first-class man. Thoroughly familiar with all metals and can furnish the best of references. Address EASTERN, care THE METAL INDUSTRY.

PLATERS AND POLISHERS

ELECTRO-PLATERS

Any one desiring the services of first class men for the electro-deposition of metals and finishing in all branches and departments of the plating business can secure such services by corresponding with the Secretary of the American Electro-Platers' Society.

FRED C. CLEMENT, 462 N. 50th STREET, PHILADELPHIA, PA.

SITUATION WANTED—FOREMAN NICKEL PLATER and POLISHER. Thorough, practical, up-to-date man in the business. Can show modern ways in plating and polishing. Would like to correspond with some manufacturers in any manufacturing line of metal goods and specialties. Have had years of experience in handling men and producing results and have installed modern plating plants. Can furnish the best of references. Address PRACTICAL, care THE METAL INDUSTRY.

SITUATION WANTED—DIE CASTINGS, by A-1 PLATER and POLISHER. Capable of taking charge. Address DIE CASTINGS, care THE METAL INDUSTRY.

SITUATION WANTED—By Foreman Plater and Polisher. Have had, for 12 years, charge of a large manufacturing company at Cleveland, Ohio. Would like to hear from some good, reliable firm in need of a foreman. Address HUSTLER, care THE METAL INDUSTRY.

SITUATION WANTED—By a First-class Foreman Plater and Polisher in Brass Goods Factory. Can make all solutions, dips and finishes; Barrel Plating, Wet and Dry Tumbling, also Ball Burnishing. Have most up-to-date methods of Polishing and Buffing. Address E., care THE METAL INDUSTRY.

SITUATION WANTED—Position as Foreman Plater; 28 years' experience and thoroughly familiar with all solutions. Can take charge of Polishing and Plating room, also am able to start new plants. Address ELMHURST, care THE METAL INDUSTRY.

SITUATION WANTED—Gold and silver electro-plater can do all kinds of coloring and mix all solutions, wishes position with good house. A. L. A., care METAL INDUSTRY.

A PARTIAL LIST OF THE PRINCIPAL ARTICLES PUBLISHED IN THE METAL INDUSTRY DURING 1913

ADVERTISERS' PRODUCTS AND BUYERS' GUIDE

Abrasives.
Bennett-O'Connell Co., Chicago, Ill.
Buchanan, Thos., Co., Cincinnati, O.
Detroit Platers' Supply Co., Detroit, Mich.
Hanson & Van Winkle Co., Newark, N. J.
Munning-Loeb Co., Matawan, N. J.
Williamsville Buff Mfg. Co., Danielson, Conn.

Accumulators, Hydraulic.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Watson-Stillman Co., New York.
Wood, R. D., & Co., Philadelphia, Pa.

Acid, Hydrofluoric (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Cooper, Charles, & Co., New York.
Detroit Platers' Supply Co., Detroit, Mich.
General Chemical Co., Philadelphia, Pa.
Hanson & Van Winkle Co., Newark, N. J.
Kalbfleisch, Franklin H., Co., New York.
McKesson & Robbins, New York.
Wiarda & Co., John C., Brooklyn, N. Y.

Acid, Muriatic (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Cooper, Charles, & Co., New York.
Detroit Platers' Supply Co., Detroit, Mich.
Hanson & Van Winkle Co., Newark, N. J.
Niagara Alkali Co., Niagara Falls, N. Y.

Acid, Nitric.
Hanson & Van Winkle Co., Newark, N. J.
Kalbfleisch, Franklin H., Co., New York.

Acid-Proof Stoneware.
German-American Stoneware Works, New York.

Acid, Sulphuric (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Cooper, Charles, & Co., New York.
Detroit Platers' Supply Co., Detroit, Mich.
Hanson & Van Winkle Co., Newark, N. J.
Hegeler Bros., Danville, Ill.
Illinois Zinc Co., Peru, Ill.
Kalbfleisch, Franklin H., Co., New York.
Matthiesen & Hegeler Zinc Co., La Salle, Ill.
McKesson & Robbins, New York.

Air Brushes and Accessories.
Eclipse Air Brush & Compressor Co., Newark, N. J.
Eureka Pneumatic Spray Co., New York.

Air Compressors.
Eclipse Air Brush & Compressor Co., Newark, N. J.
Eureka Pneumatic Spray Co., New York.
General Electric Co., Schenectady, N. Y.
Leiman Bros., New York.
Pangborn Corporation, Hagerstown, Md.

Air Filters.
Eclipse Air Brush & Compressor Co., Newark, N. J.
Eureka Pneumatic Spray Co., New York.

Alloys (Carbon Free).
Goldschmidt Thermit Co., New York.

Alloys Made to Specifications.
Ajax Metal Co., Philadelphia, Pa.
American Manganese Bronze Co., New York.
Atkinson Co., The, Rochester, N. Y.
Birkenstein, S., & Sons, Chicago, Ill.
Columbia Smelting & Refining Works, New York.
Damascus Bronze Co., Pittsburg, Pa.
Delaware Metal Refinery, Philadelphia, Pa.
Electric Smelting & Alum'n Co., Lockport, N. Y.
Fitz, Dana & Co., Boston, Mass.
Genesee Metal Co., Rochester, N. Y.
Goldschmidt Thermit Co., New York.
Lang, R. F., New York.
Leavitt, C. W., & Co., New York.
Michigan Smelting & Refining Co., Detroit, Mich.
North American Smelting Co., Philadelphia, Pa.
Phosphor Bronze Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Riverside Metal Co., Riverside, N. J.
Standard Rolling Mills Inc., Brooklyn, N. Y.

Aluminum Alloys.
Birkenstein, S., & Sons, Chicago, Ill.
Delaware Metal Refinery, Philadelphia, Pa.
Electric Smelting & Alum'n Co., Lockport, N. Y.
Fitz, Dana & Co., Boston, Mass.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
U. S. Reduction Co., Chicago, Ill.

Aluminum Bronze Ingots.
Electric Smelting & Alum'n Co., Lockport, N. Y.

Aluminum Buffing Compositions.
(See also Platers' Supplies).
Zucker, Geo., Co., Newark, N. J.

Aluminum Castings.
Aluminum Company of America, Pittsburg, Pa.
Aluminum Goods Mfg. Co., Manitowoc, Wis.
Atkinson Co., The, Rochester, N. Y.
Light Foundry & Mfg. Co., Pottstown, Pa.

Aluminum Electrical Conductors.
Aluminum Company of America, Pittsburg, Pa.

Aluminum, Granulated.
U. S. Reduction Co., Chicago, Ill.
Standard Rolling Mills Inc., Brooklyn, N. Y.

Aluminum Ingots.
Aluminum Company of America, Pittsburg, Pa.
Birkenstein, S., & Sons, Chicago, Ill.
Electric Smelting & Alum'n Co., Lockport, N. Y.
Fitz, Dana & Co., Boston, Mass.
Hirsch, L. C., & Co., New York.
Kemp, W. H., Co., New York.
Leavitt, C. W., & Co., New York.
Michigan Smelting & Refining Co., Detroit, Mich.
Richards & Co., Boston, Mass.
Standard Rolling Mills Inc., Brooklyn, N. Y.
Trotter, Nathan, & Co., Philadelphia, Pa.
U. S. Reduction Co., Chicago, Ill.

Aluminum Manufactured Goods, Sheet (See also Metal Goods made to order).
Aluminum Goods Mfg. Co., Manitowoc, Wis.

Aluminum Match Plates.
Turner Machine Co., Philadelphia, Pa.

Aluminum Moldings and Extruded Shapes.
Aluminum Company of America, Pittsburg, Pa.

Aluminum Powder, Leaf and Foil.
Kemp, W. H., Co., New York.

Aluminum Rivets.
Hassall, John, Inc., Brooklyn, N. Y.
Kemp, W. H., Co., New York.

Aluminum Sheets, Rods and Wire.
Aluminum Company of America, Pittsburg, Pa.
Electric Smelting & Alum'n Co., Lockport, N. Y.
Kemp, W. H., Co., New York.
Richards & Co., Boston, Mass.
Standard Rolling Mills Inc., Brooklyn, N. Y.

Aluminum Shoes.
Racine Aluminum Shoe Co., Racine Wis.

Aluminum Solder (See Solder).

Aluminum Tubes.
Aluminum Company of America, Pittsburg, Pa.
Kemp, W. H., Co., New York.

Ammeters and Voltmeters (See also Platers' Supplies).
Bristol Co., The, Waterbury, Conn.
Hanson & Van Winkle Co., Newark, N. J.

Amyl Acetate (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Cooper, Charles, & Co., New York.
International Smokeless Powder & Chemical Co., New York.
McKesson & Robbins, New York.
New Era Lustre Co., New York.
Nichols, G. J., & Co., Chicago, Ill.
Wiarda & Co., John C., Brooklyn, N. Y.

Annealing Muffles.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Rockwell, W. S., Co., New York.

Annealing Pans.
Sly, W. W., Mfg. Co., Cleveland, O.

Anodes, Brass, Copper or Nickel (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Ayer Mfg. Co., New Haven, Conn.
Backus & Leeser Co., New York.
Bennett-O'Connell Co., Chicago, Ill.
Bowers, B. O., Co., New York.
Bridgeport Brass Co., Bridgeport, Conn.
Detroit Platers' Supply Co., Detroit, Mich.
Hachmeister-Lind Chemical Co., Pittsburg, Pa.
Hanson & Van Winkle Co., Newark, N. J.
Haas Manufacturing Co., New York.
Hussey, C. G., & Co., Pittsburg, Pa.
McKesson & Robbins, New York.
Munning-Loeb Co., Matawan, N. J.
Neubeck, Adolf, Buffalo, N. Y.
Seymour Manufacturing Co., The, Seymour, Conn.
Stamford German Silver Co., Stamford, Conn.
Stevens, Frederic B., Detroit, Mich.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.
Wiarda & Co., John C., Brooklyn, N. Y.
Wyckoff, H. S., Co., Newark, N. J.

Anodes, Gold or Silver.
Bennett-O'Connell Co., Chicago, Ill.
Hanson & Van Winkle Co., Newark, N. J.
Jackson, John J., Newark, N. J.

Anodes, Platinum (See Platers' Supplies).

Anodes, Silver (See also Platers' Supplies).
Jackson, John J., Newark, N. J.
Ney, J. M., Co., Hartford, Conn.
Renziehausen, Wm. F., Co., Newark, N. J.

Anodes, Zinc (See also Platers' Supplies).
Bennett-O'Connell Co., Chicago, Ill.
Hanson & Van Winkle Co., Newark, N. J.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.
Wiarda & Co., John C., Brooklyn, N. Y.

Antimonial Lead.
Leavitt, C. W., & Co., New York.
North American Smelting Co., Philadelphia, Pa.
Standard Rolling Mills, Inc., Brooklyn, N. Y.

Antimony Metal.
Birkenstein, S., & Sons, Chicago, Ill.
Brooks Solder & Metal Works, Baltimore, Md.
Cooper, Charles, & Co., New York.
Fitz, Dana & Co., Boston, Mass.
Hendricks Bros., New York.
Leavitt, C. W., & Co., New York.
McKesson & Robbins, New York.
Michigan Smelting & Refining Co., Detroit, Mich.
Richards & Co., Boston, Mass.
Trotter, Nathan, & Co., Philadelphia, Pa.
U. S. Reduction Co., Chicago, Ill.
Wiarda & Co., John C., Brooklyn, N. Y.

Assayers and Chemists.
Dover Laboratory, Dover, N. J.
Krom, L. J., New York.
Ledoux & Co., New York.
Robinson, Louis G., Cincinnati, O.

Automatic Buffing and Polishing Machines.
Baltimore Tube Co., Baltimore, Md.

Automatic Disc Polishing Machines.
Baltimore Tube Co., Baltimore, Md.

Automatic Drop Lifters.
Peck Drop Press Works, New Haven, Conn.

Automatic Wire and Metal Working Machinery.
Blake & Johnson Co., Waterbury, Conn.
Bliss, E. W., Brooklyn, N. Y.
Shuster, F. B., Co., New Haven, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Babbitt Metals.
Ajax Metal Co., Philadelphia, Pa.
American Manganese Bronze Co., New York.
Atkinson Co., The, Rochester, N. Y.
Benson, H. K. & F. S., Glen Ridge, N. J.
Birkenstein, S., & Sons, Chicago, Ill.
Brooks Solder & Metal Works, Baltimore, Md.
Columbia Smelting & Refining Works, New York.
Damascus Bronze Co., Pittsburg, Pa.
Electric Smelt. & Aluminum Co., Lockport, N. Y.
Fitz, Dana & Co., Boston, Mass.
Michigan Smelting & Refining Co., Detroit, Mich.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Riverside Metal Co., Riverside, N. J.
Riverside Metal Refining Co., Connellsville, Pa.

Babbitt Molds.
Schweizer, Chas. K., Co., St. Louis, Mo.

Bakelite.
General Bakelite Co., New York.

Ball-Bearing Polishing Lathes.
Bennett-O'Connell Co., Chicago, Ill.
Gardner Machine Co., Beloit, Wis.

Balls, Steel, for Burnishing.
Abbott Ball Co., Hartford, Conn.
Globe Machine & Stamping Co., Cleveland, O.

Barium Cyanide.
Berkel, Wm., Chemical Works, Jersey City, N. J.

Belt Lacing, Metallic.
Bristol Co., The, Waterbury, Conn.

Belts, Polishing.
Ames Sword Co., Chicopee, Mass.
Bennett-O'Connell Co., Chicago, Ill.
Hanson & Van Winkle Co., Newark, N. J.

Bends and Coils, Brass, Copper, Iron.
Baltimore Tube Co., Baltimore, Md.

Bismuth.
Cooper, Charles, & Co., New York.
Fitz, Dana & Co., Boston, Mass.
Hendricks Brothers, New York.
Leavitt, C. W., & Co., New York.
McKesson & Robbins, New York.
Michigan Smelting & Refining Co., Detroit, Mich.
Richards & Co., Boston, Mass.
Trotter, Nathan, & Co., Philadelphia, Pa.

Block Tin (See Tin).

Block Tin Pipe.
North American Smelting Co., Philadelphia, Pa.
Standard Rolling Mills, Inc., Brooklyn, N. Y.

Blowers and Blow Piping.
Cleveland Blow Pipe & Mfg. Co., Cleveland, O.
Kirk & Blum, Cincinnati, O.
Knickerbocker Company, Jackson, Mich.
Leiman Bros., New York.
Northern Blower Co., Cleveland, O.

Boron Flux.
General Electric Co., Schenectady, N. Y.

Brass and Bronze Architectural Work.
Manhattan Brass Co., New York.

Brass Ingots and Castings.
Ajax Metal Co., Philadelphia, Pa.
American Manganese Bronze Co., New York.
American Tool & Machine Co., Boston, Mass.
Birkenstein, S., & Sons, Chicago, Ill.
Damascus Bronze Co., Pittsburg, Pa.
Genesee Metal Co., Rochester N. Y.
Michigan Smelting & Refining Co., Detroit, Mich.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Riverside Metal Co., Riverside, N. J.
Riverside Metal Refining Co., Connellsville, Pa.
Taunton-New B'f'd Copper Co., New Bedford, Mass.
Walsh's Sons, M. L., & Co., Newark, N. J.
White & Bro., Inc., Philadelphia, Pa.

Brass, Bronze Copper and Oreide Sheet Wire, Rod, Etc.
American Brass Co., The, Waterbury, Conn.
American Manganese Bronze Co., New York.
Benson, H. K. & F. S., Glen Ridge, N. J.

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Bridgeport Brass Co., Bridgeport, Conn.
Damascus Bronze Co., Pittsburg, Pa.
Hendricks Bros., New York.
Hussey, C. G., & Co., Pittsburg, Pa.
Manhattan Brass Co., New York.
Pilling Brass Co., Waterbury, Conn.
Phosphor Bronze Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Riverside Metal Co., Riverside, N. J.
Scovill Manufacturing Co., Waterbury, Conn.
Seymour Manufacturing Co., The, Seymour, Conn.
Taunton-New B'f'd Copper Co., New Bedford, Mass.

Brass, Bronze, Copper and Oreide Tubes.
American Brass Co., The, Waterbury, Conn.
Baltimore Tube Co., Baltimore, Md.
Bridgeport Brass & Copper Co., The, New York.
Manhattan Brass Co., New York.
Merchant & Evans Co., Philadelphia, Pa.
Riverside Metal Co., Riverside, N. J.
Scovill Manufacturing Co., Waterbury, Conn.
Seymour Manufacturing Co., The, Seymour, Conn.
Wells, A. H., Co., Waterbury, Conn.

Brass Foundry Equipment (See Foundry Supplies and Equipment).

Brass Furnace Linings.
Gill Clay Pot Co., Muncie, Ind.

Brass Goods, Plumbers'.
Atkinson Co., The, Rochester, N. Y.
Baltimore Tube Co., Baltimore, Md.
Bridgeport Brass Co., Bridgeport, Conn.
Manhattan Brass Co., New York.
Schroeder, Edw., Lamp Works, Jersey City, N. J.

Brazing Solder (See Solder).

Britannia Metal.
Benson, H. K. & F. S., Glen Ridge, N. J.
Standard Rolling Mills, Inc., Brooklyn, N. Y.

Bronze and Composition Ingots and Castings.
Ajax Metal Co., Philadelphia, Pa.
American Brass Co., The, Waterbury, Conn.
American Manganese Bronze Co., New York.
American Tool & Machine Co., Boston, Mass.
Atkinson Co., The Rochester, N. Y.
Damascus Bronze Co., Pittsburg, Pa.
Fitz, Dana & Co., Boston, Mass.
Genesee Metal Co., Rochester, N. Y.
Lang, R. F., New York.
North American Smelting Co., Philadelphia, Pa.
Phosphor Bronze Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Riverside Metal Co., Riverside, N. J.
Riverside Metal Refining Co., Connellsville, Pa.
Taunton-New B'f'd Copper Co., New Bedford, Mass.

Bronze Sheets, Wire, Rods, Etc. (See Brass, Bronze and Copper Sheets, etc.).

Bronze Tubes (See Brass, Bronze and Copper Tubes).

Brushes, Wire and Bristle (See also Foundry Supplies and Platers' Supplies).
Bennett-O'Connell Co., Chicago, Ill.
Blumenthal, Hermann, New York.
Gornell, E., & Sons, Chicago, Ill.
Hanson & Van Winkle Co., Newark, N. J.
Manufacturers' Brush Co., Cleveland, O.
Munning-Loeb Co., Matawan, N. J.
Osborn Manufacturing Co., Cleveland, O.
Paxson, J. W., Co., Philadelphia, Pa.

Buckle Machinery (See Automatic Wire and Metal Working Machinery).

Buckle Tongues.
Campbell-Warner Co., Middletown, Conn.

Buffing Machinery (See Polishing, Buffing and Burnishing Machinery).

Buffing and Polishing Compositions.
(See also Platers' Supplies.)
Ayer Mfg. Co., New Haven, Conn.
Bennett-O'Connell Co., Chicago, Ill.
Detroit Platers' Supply Co., Detroit, Mich.
Hanson & Van Winkle Co., Newark, N. J.
Hill & Griffith Co., Cincinnati, O.
Munning-Loeb Co., Matawan, N. J.
Zucker, Geo., Co., Newark, N. J.

Buffing and Polishing Supplies (See Polishing and Buffing Machinery and Equipment).

Buffing and Polishing Wheels (See also Platers' Supplies).
Ayer Mfg. Co., New Haven, Conn.
Bennett-O'Connell Co., Chicago, Ill.
Hanson & Van Winkle Co., Newark, N. J.
Munning-Loeb Co., Matawan, N. J.
Stevens, Frederic B., Detroit, Mich.
Williamsville Buff Mfg. Co., Danielson, Conn.

Bull-Dozers.
Wood, R. D., & Co., Philadelphia, Pa.

Burners, Fuel Oil or Gas (See also Foundry Supplies).
Hawley Down Draft Furnace Co., Easton, Pa.
Monarch Eng. & Mfg. Co., Baltimore, Md.
Pangborn Corporation, Hagerstown, Md.
Rockwell, W. S., & Co., New York.

Burnishing Barrels (See also Platers' Supplies).
Abbott Ball Co., Hartford, Conn.
Bennett-O'Connell Co., Chicago, Ill.
Detroit Platers' Supply Co., Detroit, Mich.
Globe Machine & Stamping Co., Cleveland, O.
Hanson & Van Winkle Co., Newark, N. J.
Smith, Richardson Co., Attleboro, Mass.
Tolhurst Machine Works, Troy, N. Y.
Woodison, E. J., Co., Detroit, Mich.

Burnishing Barrels, Leather Meal for
Hanson & Van Winkle Co., Newark, N. J.
Peckham Mfg. Co., Newark, N. J.

Burnishing Compounds and Chips (See also Platers' and Polishers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
International Chemical Co., Camden, N. J.
Stevens, Frederic B., Detroit, Mich.

Button Machinery (See Automatic Wire and Metal Working Machinery).

Cabbaging Presses.
Farrel Foundry & Machine Co., Ansonia, Conn.
Wood, R. D., & Co., Philadelphia, Pa.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Watson-Stillman Co., New York.

Cadmium, Metallic.
Cooper, Charles & Co., New York.
Leavitt, C. W., & Co., New York.
Fitz, Dana & Co., Boston, Mass.
McKesson & Robbins, New York.
Richards & Co., Boston, Mass.

Carborundum.
Buchanan, Thos., & Co., Cincinnati, O.

Carboy Rockers.
Munning-Loeb Co., Matawan, N. J.

Castings (See also name of metal wanted).

Castings, Iron Machinery.
American Tool & Machine Co., Boston, Mass.
Bliss Co., E. W., Brooklyn, N. Y.
Farrel Foundry & Machine Co., Ansonia, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Wood, R. D., & Co., Philadelphia, Pa.

Caustic Potash (See Platers', Polishers' and Galvanizers' Supplies).

Centrifugal Dryers and Extractors.
American Tool & Machine Co., Boston, Mass.
Hanson & Van Winkle Co., Newark, N. J.
No-Dust Drying Machine Co., Providence, R. I.
Tolhurst Machine Works, Troy, N. Y.

Chain Machinery (See Automatic Wire and Metal Working Machinery).

Chaplets, Perforated (See Foundry Supplies).

Charcoal, Powdered and Granulated.
Paxson, J. W., Co., Philadelphia, Pa.

Chemicals (See Platers' Supplies).

Chemists.
Krom, L. J., New York.
Ledoux & Co., New York.
Robinson, Louis G., Cincinnati, O.

Chucks.
American Tool & Machine Co., Boston, Mass.

Chucks, Spinning.
Bliss, E. W., Co., Brooklyn, N. Y.
Pryibil, P., Inc., New York.
Wilcor Manufacturing Co., Chicago, Ill.

Cinder Mills (See Crushers).

Cleaning Compounds, Metal (See also Platers' Supplies).
Anthony, H. M., & Co., New York.
Apothecaries Hall Co., Waterbury, Conn.
Backus & Leeser Co., New York.
Bennett-O'Connell Co., Chicago, Ill.
Bowers, B. O., Co., New York.
Cleveland Platers' Supply Co., Cleveland, O.
Detroit Platers' Supply Co., Detroit, Mich.
Electric Smelt. & Aluminum Co., Lockport, N. Y.
Hachmeister-Lind Chemical Co., Pittsburg, Pa.
Hanson & Van Winkle Co., Newark, N. J.
International Chemical Co., Camden, N. J.
Munning-Loeb Co., Matawan, N. J.
Stevens, Frederic B., Detroit, Mich.
Swan & Finch Co., New York.
Wiarda & Co., John C., Brooklyn, N. Y.
Wyckoff, H. S., Co., Newark, N. J.

Cock Grinders, Automatic.
Turner Machine Co., Philadelphia, Pa.

Cold Rolling Mills.
Engineering Products Co., New York.

Composition Metal Tacks, Nails, Etc.
Hussey, C. G., & Co., Pittsburg, Pa.

Compositions, Buffing (See also Platers' Supplies).
Ayer Mfg. Co., New Haven, Conn.
Bennett-O'Connell Co., Chicago, Ill.
Hanson & Van Winkle Co., Newark, N. J.
Munning-Loeb Co., Matawan, N. J.
Zucker, George, Co., Newark, N. J.

Consulting Platers (See also Expert Instruction).

Conveyors.
Pangborn Corporation, Hagerstown, Md.

Copper Bearing Material, Buyers of (See Metal Turnings, Drosses, Residues, Etc.).

Copper, Carbonate of
Apothecaries Hall Co., Waterbury, Conn.
Bennett-O'Connell Co., Chicago, Ill.
Cooper, Charles, & Co., New York.
Hachmeister-Lind Chemical Co., Pittsburg, Pa.
Munning-Loeb Co., Matawan, N. J.
Hanson & Van Winkle Co., Newark, N. J.
Wiarda & Co., John C., Brooklyn, N. Y.

Copper Castings.
Ajax Metal Co., Philadelphia, Pa.
American Manganese Bronze Co., New York.
Atkinson Co., The, Rochester, N. Y.

Copper Ingots.
Balbach Smelting & Refining Co., Newark, N. J.
Birkenstein, S., & Sons, Chicago, Ill.
Fitz, Dana & Co., Boston, Mass.
Hendricks Brothers, New York.
Lang, R. F., New York.
Leavitt, C. W., & Co., New York.
Michigan Smelting & Refining Co., Detroit, Mich.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Riverside Metal Co., Riverside, N. J.
Riverside Metal Refining Co., Connellsville, Pa.
Standard Rolling Mills, Inc., Brooklyn, N. Y.
Taunton-New B'f'd Copper Co., New Bedford, Mass.
Trotter, Nathan, & Co., Philadelphia, Pa.
United Metals Selling Co., New York.
White & Bro., Inc., Philadelphia, Pa.

Copper Nails and Tacks.
Hassall, John, Inc., New York.
Hussey, C. G., & Co., Pittsburg, Pa.
Scoville Manufacturing Co., Waterbury, Conn.
Taunton-New B'f'd Copper Co., New Bedford, Mass.

Copper Rivets.
Hassall, John, Inc., New York.
Hendricks Bros., New York.

Copper Sheets, Wire, Rods, Bolts, Etc. (See Brass, Bronze and Copper Sheets, etc.).

Copper, Shot.
Riverside Metal Co., Riverside, N. J.
Seymour Manufacturing Co., Seymour, Conn.

Copper, Sulphate of
Apothecaries Hall Co., Waterbury, Conn.
Detroit Platers' Supply Co., Detroit, Mich.
Munning-Loeb Co., Matawan, N. J.

Copper Tubes (See Brass and Copper Tubes).

Core Compound (See also Foundry Supplies).
Dixon, Jos., Crucible Co., Jersey City, N. J.
Hill & Griffith Co., Cincinnati, O.
Paxson, J. W., Co., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.

Core Machines.
Pangborn Corporation, Hagerstown, Md.

Core Oil (See Core Compound).

Core Ovens (See also Foundry Supplies).
Gehnrich, Hermann, New York.
Hill & Griffith Co., Cincinnati, O.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Oven Equipment & Mfg. Co., New Haven, Conn.
Pangborn Corporation, Hagerstown, Md.
Steiner, E. E., Newark, N. J.

Corrugated Tubing, Brass.
Baltimore Tube Co., Baltimore, Md.

Countershafts, Ball Bearing.
Gardner Machine Co., Beloit, Wis.

Crocus and Buffing Compositions (See also Platers' Supplies).
Ayer Mfg. Co., New Haven, Conn.
Bennett-O'Connell Co., Chicago, Ill.
Detroit Platers' Supply Co., Detroit, Mich.
Hanson & Van Winkle Co., Newark, N. J.
Munning-Loeb Co., Matawan, N. J.
Zucker, Geo., Co., Newark, N. J.

Crucibles, Stirrers, Stoppers, Nozzles, Etc. (See also Foundry Supplies).
Bartley, Jonathan, Crucible Co., Trenton, N. J.
Dixon, Jos., Crucible Co., Jersey City, N. J.
Gautier, J. H., & Co., Jersey City, N. J.
McCullough Dalzell Crucible Co., Pittsburg, Pa.
Ross-Tacomy Crucible Co., Philadelphia, Pa.
Seidel, R. B., Inc., Philadelphia, Pa.
Taylor, R. J., Inc., Philadelphia, Pa.

Crushers, Cinder (See also Foundry Supplies).
Farrel Foundry & Machine Co., Ansonia, Conn.
Moussette, O. J., Co., Brooklyn, N. Y.
Osborn Mfg. Co., Cleveland, O.
Paxson, J. W., Co., Philadelphia, Pa.
Sly, W. W., Mfg. Co., Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Cube Nickel.
Detroit Platers' Supply Co., Detroit, Mich.
United States Nickel Co., New Brunswick, N. J.

Cupolas.
Paxson, J. W., Co., Philadelphia, Pa.

Cyanide of Potassium (See Platers' Supplies).

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Cyanide of Sodium.
Hachmeister-Lind Chemical Co., Pittsburg, Pa.
Hanson & Van Winkle Co., Newark, N. J.
Roessler & Hasslacher Chemical Co., New York.

Decorated Metals in Sheets and Strips.
Hirsch, L. C., & Co., New York.

Deoxidizers for Copper.
General Electric Co., Schenectady, N. Y.

Die-Castings.
Finished Parts Mfg. Co., Newark, N. J.

Dies, Sheet Metal Working.
Bliss, E. W., Co., Brooklyn, N. Y.
Globe Machine & Stamping Co., Cleveland, O.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Dipping Baskets, Stoneware.
German-American Stoneware Works, New York.

Disc Polishing and Grinding Machines.
Baltimore Tube Co., Baltimore, Md.
Gardner Machine Co., Beloit, Wis.

Draw Benches—Wire, Rod and Tube.
Farrel Foundry & Machine Co., Ansonia, Conn.
Leiman Bros., New York.
Torrington Mfg. Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Watson-Stillman Co., New York.
Wood, R. D., & Co., Philadelphia, Pa.

Drosses (See Metal Turnings, Drosses, etc.).

Drop Hammers.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Drying-Out Machines.
American Tool & Machine Co., Boston, Mass.
No-Dust Drying Machine Co., Providence, R. I.
Smith, Richardson Co., Attleboro, Mass.
Tolhurst Machine Works, Troy, N. Y.
Torrington Mfg. Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Dust Collectors and Ventilating Systems.
Cleveland Blow Pipe & Mfg. Co., Cleveland, O.
Kirk & Blum, Cincinnati, O.
Knickerbocker Co., The, Jackson, Mich.
Leiman Bros., New York.
Northern Blower Co., Cleveland, O.
Pangborn Corporation, Hagerstown, Md.
Sly, W. W., Mfg. Co., Cleveland, O.

Dynamos, Platers' and Galvanizers' (See also Platers' Supplies).
Backus & Leeser Co., New York.
Bennett-O'Connell Co., Chicago, Ill.
Bogue, Chas. J., Electric Co., New York.
Connecticut Dynamo & Motor Co., Irvington, N. J.
General Electric Co., Schenectady, N. Y.
Hanson & Van Winkle Co., Newark, N. J.
L'Hommedieu, Chas. F., & Sons Co., Chicago, Ill.
Munning-Loeb Co., Matawan, N. J.
Stevens, Frederic B., Detroit, Mich.
Wyckoff, H. S., Co., Newark, N. J.

Electric Cleaning Compounds (See Cleaning Compounds, Metal).

Electrochroma Solutions.
Rojas Electro Chemical Co., New York.

Electrogalvanizing Machines (See Galvanizing Barrels and Apparatus).

Electrolytically Deposited Engine Manifold.
Baltimore Tube Co., Baltimore, Md.

Electroplaters' Centrifugal Dryers.
American Tool & Machine Co., Boston, Mass.
No-Dust Drying Machine Co., Providence, R. I.
Tolhurst Machine Works, Troy, N. Y.

Electroplating, Polishing, Coloring, Etc.
Autoyre Co., Oakville, Conn.
Hassall, John, Inc., Brooklyn, N. Y.
Neubeck, Adolf, Buffalo, N. Y.
Trichlinger, J., New York.
Waterbury Metal Products Co., Waterbury, Conn.

Embossed Zinc, Tin and Steel Sheets.
Hirsch, L. C., & Co., New York.

Emery (See also Platers' Supplies).

Emery Wheels (See also Grinding Machinery, etc.).
Williamsville Buff Mfg. Co., Danielson, Conn.

Enameling and Japanning Ovens.
Gehnrich, Hermann, New York.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Oven Equipment & Mfg. Co., New Haven, Conn.
Steiner, E. E., Newark, N. J.

Enamels, Lacquer (See Lacquer Enamels).

Engineers, Consulting Mechanical.
Lewis, Jos. E., Baltimore, Md.
Thompson, Guion, Waterbury, Conn.
Thompson, Hugh L., Waterbury, Conn.

Engineers, Foundry.
Pangborn Corporation, Hagerstown, Md.
Smith, J. D., Foundry Supply Co., Cleveland, O.

Engineers, Furnace.
Kenworthy, Chas. F., Waterbury, Conn.

Escutcheon Pins, All Metals.
Hassall, John, New York.

Etched Name Plates.
Schweizer, Max, Bridgeport, Conn.

Exhaust Fans.
Cleveland Blow Pipe & Mfg. Co., Cleveland, O.
Knickerbocker Co., Jackson, Mich.
Leiman Bros., New York.
Northern Blower Co., Cleveland, O.

Exhaust Fans, Stoneware.
German-American Stoneware Works, New York.
Pangborn Corporation, Hagerstown, Md.

Expert Instruction—Plating, Coloring, Dipping, Etching, Etc.
Rojas Electro Chemical Co., New York.
Rockwell Furnace Co., New York.
Rockwell, W. S., Co., New York.
Schweizer, Max, Bridgeport, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Extractors, Centrifugal Drying.
American Tool & Machine Co., Boston, Mass.
Tolhurst Machine Works, Troy, N. Y.

Facings (See Foundry Facings).

Felt Polishing Wheels.
Hanson & Van Winkle Co., Newark, N. J.
Munning-Loeb & Co., Matawan, N. J.

Fig Cleanser.
International Chemical Co., Camden, N. J.

Fillets, Leather (See Foundry Supplies and Equipment).

Fire Brick (See also Foundry Supplies).
Gill Clay Pot Co., Muncie, Ind.
Stevens, Frederic B., Detroit, Mich.

Flasks, Aluminum Snap.
Monarch Engineering & Mfg. Co., Baltimore, Md.

Flasks, Brass Molders' (See also Foundry Supplies).
Monarch Engineering & Mfg. Co., Baltimore, Md.

Flexible Tubing.
Baltimore Tube Co., Baltimore, Md.

Fluxes for Metals.
General Electric Co., Schenectady, N. Y.

Fluxes, Soldering and Tinning.
Richards & Co., Boston, Mass.

Forming Machines (See Automatic Wire and Metal Working Machinery).

Forgings, Automobile.
American Manganese Bronze Co., New York.
Bliss, E. W., Co., Brooklyn, N. Y.
Phosphor Bronze Smelting Co., Philadelphia, Pa.

Foundry Facings (See Foundry Supplies).

Foundry Pails, Kegs, Etc.
Sly, W. W., Mfg. Co., Cleveland, O.

Foundry Supplies and Equipment (See also Foundry Facings, Furnaces, etc.).
Birkenstein, S., & Sons, Chicago, Ill.
Dixon, Jos., Crucible Co., Jersey City, N. J.
Gehnrich, Hermann, New York.
Gill Clay Pot Co., Muncie, Ind.
Hawley Down Draft Furnace Co., Easton, Pa.
Hill & Griffith Co., Cincinnati, O.
Ideal Furnace Co., Chester, Pa.
Kroeschell Bros. Co., Chicago, Ill.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Moussette, O. J., Co., Brooklyn, N. Y.
Osborn Mfg. Co., Cleveland, O.
Oven Equipment & Mfg. Co., New York.
Pangborn Corporation, Hagerstown, Md.
Paxson, J. W., Co., Philadelphia, Pa.
Rockwell, W. S., Co., New York.
Smith, J. D., Foundry Supply Co., Cleveland, O.
Steiner, E. E., Newark, N. J.
Stevens, Frederic B., Detroit, Mich.
Turner Machine Co., Philadelphia, Pa.
Woodison, E. J., Co., Detroit, Mich.

Friction Clutches.
American Tool & Machine Co., Boston, Mass.

Furnace Linings (See Foundry Supplies).

Furnaces, Annealing, Brazing, Etc.
Kenworthy, Chas. F., Waterbury, Conn.
Monarch Engineering & Mfg. Co., Baltimore, Md
Rockwell, W. S., Co., New York.

Furnaces, Crucible (See Furnaces, Melting).

Furnaces, Electric.
Bristol Co., The, Waterbury, Conn.

Furnaces, Galvanizing and Tinning.
Farrel Foundry & Machine Co., Ansonia, Conn.
Kenworthy, Chas. F., Waterbury, Conn.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Rockwell, W. S., Co., New York.

Furnaces, Melting, for Oil, Coal, Coke or Gas (See also Foundry Supplies).
Hawley Down Draft Furnace Co., Easton, Pa.
Ideal Furnace Co., Chester, Pa.
Kenworthy, Chas. F., Waterbury, Conn.
Kroeschell Bros. Co., Chicago, Ill.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Paxson, J. W., Co., Philadelphia, Pa.
Rockwell, W. S., Co., New York.
Smith, J. D., Foundry Supply Co., Cleveland, O.
Stevens, Frederic B., Detroit, Mich.

Furnaces, Reverberatory.
Hawley Down Draft Furnace Co., Easton, Pa.
Kenworthy, Chas. F., Waterbury, Conn.
Monarch Engineering & Mfg. Co., Baltimore, Md.
Rockwell, W. S., Co., New York.

Fusel Oil, Refined (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Cooper, Charles, & Co., New York.
International Smokeless Powder & Chemical Co., New York.
McKesson & Robbins, New York.
New Era Lustre Co., New York.
Nikolas, G. J., & Co., Chicago, Ill.
Wiarda & Co., John C., Brooklyn, N. Y.

Galvanized Specialties, Nails, Screws, Etc.
Hassall, John, Inc., Brooklyn, N. Y.
The Meaker Co., Chicago, Ill.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

Galvanizing Barrels and Automatic Devices.
Bennett-O'Connell Co., Chicago, Ill.
Bowers, B. O., Co., New York.
Globe Machine & Stamping Co., Cleveland, O.
Hanson & Van Winkle Co., Newark, N. Y.
Meaker Co., Chicago, Ill.
Metal Treating & Equipment Co., New York.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

Galvanizing for the Trade.
Hassall, John, Inc., Brooklyn, N. Y.
The Meaker Co., Chicago, Ill.
Metal Treating & Equipment Co., New York.
U. S. Electro Galvanizing Co., Brookyn, N. Y.

Gas Producers and Power Plants.
Wood, R. D., & Co., Philadelphia, Pa.

German Silver, Ingots, Castings, Sheets, Wire Rods, Tubes.
Bridgeport Brass Co., Bridgeport, Conn.
Pilling Brass Co., Waterbury, Conn.
Riverside Metal Co., Riverside, N. J.
Scoville Manufacturing Co., Waterbury, Conn.
Seymour Manufacturing Co., The, Seymour, Conn.
Stamford German Silver Co., Stamford, Conn.

Gold Alloys.
Riverside Metal Co., Riverside, N. J.

Gold Anodes (See Anodes).

Gold, Chloride of.
Cooper, Charles, & Co., New York.

Gold Foil.
Ney, J. M., Co., Hartford, Conn.

Gold Ingots, Bars, Plates, Etc.
Ney, J. M., Co., Hartford, Conn.
Renziehausen, Wm. F., Co., Newark, N. J.
Riverside Metal Co., Riverside, N. J.

Gold and Silver Refiners.
Jackson, John J., Co., Newark, N. J.
Ney, J. M., Co., Hartford, Conn.
Renziehausen, Wm. F., Co., Newark, N. J.
Riverside Metal Co., Riverside, N. J.

Graphite (See Foundry Supplies).

Grinding Machinery.
Baltimore Tube Co., Baltimore, Md.
Bennett-O'Connell Co., Chicago, Ill.
Buchanan, Thos., & Co., Cincinnati, O.
Connecticut Dynamo & Motor Co., Irvington, N. J.
Detroit Platers' Supply Co., Detroit, Mich.
Gardner Machine Co., Beloit, Wis.
Osborn Mfg. Co., Cleveland, O.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Grinding Wheels (See Foundry Supplies).

Gun Barrel Bluing Equipment.
Detroit Platers' Supply Co., Detroit, Mich.

Heat Gauges.
Bristol Co., Waterbury, Conn.

Hydraulic Accumulators.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Watson-Stillman Co., New York.
Wood, R. D., & Co., Philadelphia, Pa.

Hydraulic Machinery, Presses, Jacks, Etc.
Farrel Foundry & Machine Co., Ansonia, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Watson-Stillman Co., New York.
Wood, R. D., & Co., Philadelphia, Pa.

Ingot Metals (See Name of Metal Wanted).

Ingot Molds (See Molds, Ingot).

Iron, Scrap, Dealers in.
Smith Co., The Morton R., New York.

Japanning Ovens (See Enameling and Japanning Ovens).

Japans.
Apothecaries Hall Co., Waterbury, Conn.

Jewelers' Equipment and Supplies (See also Platers' Supplies).
Leiman Bros., New York.
No-Dust Drying Machine Co., Providence, R. I.
Tolhurst Machine Works, Troy, N. Y.

Jewelers' Findings.
Smith, Richardson Co. Attleboro, Mass.

Kalye.
Anthony Co., H. M., New York.

Kettles, Galvanizing and Tinning (See also Platers' Supplies).
Farrel Foundry & Machine Co., Ansonia, Conn.

Lacquer Enamels (See Lacquers and Enamels, Platers' Supplies).

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Lacquering Ovens.
Gehnrich, Hermann, New York.
Oven Equipment & Mfg. Co., New Haven, Conn.
Steiner, E. E., Newark, N. J

Lacquer Sprayers.
Eclipse Air Brush & Compressor Co., Newark, N. J.
Eureka Pneumatic Spray Co., New York.

Lacquers and Enamels (See also Platers' Supplies).
American Lacquer Co., Bridgeport, Conn.
Bennett-O'Connell Co., Chicago, Ill.
Celluloid Zapon Co., New York.
Cooper, Chas., & Co., New York.
Damard Lacquer Co., New York.
Egyptian Lacquer Manufacturing Co., New York.
Eureka Pneumatic Spray Co., New York.
General Bakelite Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
International Smokeless Powder & Chemical Co., New York.
Kalbfleisch, Franklin H., Co., New York.
New Era Lustre Co., New York.
Nikolas, G. J., & Co., Chicago, Ill.

Ladle Heaters and Dryers (See also Foundry Supplies).
Monarch Engineering & Mfg. Co., Baltimore, Md.
Pangborn Corporation, Hagerstown, Md.
Paxson, J. W., Co., Philadelphia, Pa.

Ladles (See also Foundry Supplies).
Paxson, J. W., Co., Philadelphia, Pa.

Lathers, Polishing (See Platers' and Polishers' Supplies).

Lathes, Brass Finisher's.
American Tool & Machine Co., Boston, Mass.
Bliss, E. W., Co., Brooklyn, N. Y.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Lathes, Spinning.
Prylbil, P., Inc., New York.
Wilcor Manufacturing Co., Chicago, Ill.

Lathes, Turret.
American Tool & Machine Co., Boston, Mass.

Lead, Antimonial.
Leavitt, C. W., & Co., New York.
Michigan Smelting & Refining Co., Detroit, Mich.
Richards & Co., Boston, Mass.
Standard Rolling Mills Inc., Brooklyn, N. Y.

Lead Castings, Antimonial.
Standard Rolling Mills Inc., Brooklyn, N. Y.

Lead-Coated Sheet Iron and Steel.
Ajax Metal Co., Philadelphia, Pa.

Leaden Ware and Lead Burning.
Chadwick-Boston Lead Co., Boston, Mass.
Wiarda & Co., John C., Brooklyn, N. Y.

Lead, Pig and Bar.
Atkinson Co., The, Rochester, N. Y.
Birkenstein, S., & Sons, Chicago, Ill.
Chadwick-Boston Lead Co., Boston, Mass.
Fitz, Dana & Co., Boston, Mass.
Hendricks Bros., New York.
Michigan Smelting & Refining Co., Detroit, Mich.
Richards & Co., Boston, Mass.
Standard Rolling Mills Inc., Brooklyn, N. Y.
Trotter, Nathan, & Co., Philadelphia, Pa.
United Metals Selling Co., New York.
U. S. Reduction Co., Chicago, Ill.
Walsh's Sons, M. L., & Co., Newark, N. J.

Lead Pipe.
Michigan Smelting & Refining Co., Detroit, Mich.
North American Smelting Co., Philadelphia, Pa.

Lead Strips and Moldings
Standard Rolling Mills, Inc., Brooklyn, N. Y.

Leather Meal for Dry Tumbling (See also Platers' Supplies).
Hanson & Van Winkle Co., Newark, N. J.
Peckham Mfg. Co., Newark, N. J.

Lime Compositions, Vienna (See also Platers' Supplies).
Zucker, Geo., Co., Newark, N. J.

Lubricants.
Dixon, Joseph, Crucible Co., Jersey City, N. J.

Lycopodium (See also Foundry Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Cooper, Charles, & Co., New York.
McKesson & Robbins, New York.
Wiarda & Co., John C., Brooklyn, N. Y.

Magnesium Metal.
Cooper, Charles, & Co., New York.
Leavitt, C. W., & Co., New York.
McKesson & Robbins, New York.
Roessler & Hasslacher Chemical Co., New York.

Magnetic Metal Separators (See also Foundry Supplies).
Dings Electro-Mag. Separator Co., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Pangborn Corporation, Hagerstown, Md.
Paxson, J. W., Co., Philadelphia, Pa.

Manganese Bronze (See Bronze and Composition Ingots and Castings).

Manganese 98-99%.
Goldschmidt Thermit Co., New York.

Manganese Bronze Sheets, Rods, Etc.
American Manganese Bronze Co., New York.
Bridgeport Brass Co., Bridgeport, Conn.
Taunton-New B'f'd Copper Co., New Bedford, Mass.

Manganese Copper.
Ajax Metal Co., Philadelphia, Pa.
Atkinson Co., The, Rochester, N. Y.
Electric Smelting & Alum. Co., Lockport, N. Y.
Lang, R. F., New York.
Riverside Metal Co., Riverside, N. J.
Roessler & Hasslacher Chemical Co., New York.

Manganese Metal.
Cooper, Charles, & Co., New York.
Leavitt, C. W., & Co., New York.
Roessler & Hasslacher Chemical Co., New York.

Match Plates.
Turner Machine Co., Philadelphia, Pa.

Metallurgists, Consulting.
Dover Laboratory, Dover, N. J.
Krom, L. J., New York.
Ledoux & Co., New York.
Robinson, Louis G., Cincinnati, O.

Metals (See name of metal wanted).

Metals, Dealers in All Kinds of New (See also name of metal wanted).
Andler, M. M., & Co., Boston, Mass.
Birkenstein, S., & Sons, Chicago, Ill.
Fitz, Dana & Co., Boston, Mass.
Richards & Co., Boston, Mass.
Trotter, Nathan, & Co., Philadelphia, Pa.

Metals, Dealers in Old.
Andler, M. M., & Co., Boston, Mass.
Birkenstein, S., & Sons, Chicago, Ill.
Genesee Metal Co., Rochester, N. Y.
Radnai, Josef, New York.
Riverside Metal Co., Riverside, N. J.
Smith, The Morton B., Co., New York.
Walsh's Sons, M. L., & Co., Newark, N. J.

Metals, Dealers in Old—Gold, Silver, Platinum.
Renziehausen, Wm. F., Co., Newark, N. J.
Riverside Metal Co., Riverside, N. J.

Metal Goods Drying Machines.
American Tool & Machine Co., Boston, Mass.
No-Dust Drying Machine Co., Providence, R. I.
Smith, Richardson Co., Attleboro, Mass.
Tolhurst Machine Works, Troy, N. Y.

Metal Goods Made to Order.
Aluminum Goods Mfg. Co., Manitowoc, Wis.
American Brass Co., Waterbury, Conn.
Autoyre, The, Co., Oakville, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Manhattan Brass Co., New York.
Riverside Metal Co., Riverside, N. J.
Schroeder, Edw., Lamp Works, Jersey City, N. J.
Scovill Manufacturing Co., Waterbury, Conn.
Waterbury Metal Products Co., Waterbury, Conn.

Metals, Plated Sheet.
Benson, H. K. & F. S., Glen Ridge, N. J.
Hirsch, L. C., & Co., New York.
National Sheet Metal Co., Peru, Ill.

Metal Refiners, Gold and Silver.
Genesee Metal Co., Rochester, N. Y.
Ney, J. M., Co., Hartford, Conn.
Renziehausen, Wm. F., Co., Newark, N. J.
Riverside Metal Co., Riverside, N. J.

Metal Refiners—White Metal.
Ajax Metal Co., Philadelphia, Pa.
Birkenstein, S., & Sons, Chicago, Ill.
Delaware Metal Refinery, Philadelphia, Pa.
Michigan Smelting & Refining Co., Detroit, Mich.
Standard Rolling Mills, Inc., Brooklyn, N. Y.

Metal, Silver Plated Sheet.
Benson, H. K. & F. S., Glen Ridge, N. J.

Metal Spinning (See also Metal Goods made to order).
Aluminum Goods Mfg. Co., Manitowoc, Wis.
Eberhard, George, Providence, R. I.
Riverside Metal Co., Riverside, N. J.
Standard Rolling Mills, Inc., Brooklyn, N. Y.
Waterbury Metal Products Co., Waterbury, Conn.

Metal Stamping (See also Metal Goods made to order).
Aluminum Goods Mfg. Co., Manitowoc, Wis.
Autoyre, The, Co., Oakville, Conn.
Bridgeport Brass Co., Bridgeport, Conn.
Globe Machine & Stamping Co., Cleveland, O.
Riverside Metal Co., Riverside, N. J.
Standard Rolling Mills, Inc., Brooklyn, N. Y.
Waterbury Metal Products Co., Waterbury, Conn.

Metals (Carbon Free).
Goldschmidt Thermit Co., New York.

Metal Turnings, Drosses, Residue, Etc., Buyers of.
Ajax Metal Co., Philadelphia, Pa.
Andler, M. M., & Co., Boston, Mass.
Balbach Smelting & Refining Co., Newark, N. J.
Birkenstein, S., & Sons, Chicago, Ill.
Brooks Solder & Metal Works, Baltimore, Md.
Radnai, Josef, New York.
Smith, The Morton B., Co., New York.
Walsh's Sons, M. L., & Co., Newark, N. J.
White & Bro., Inc., Philadelphia, Pa.

Mineral Cleaner.
Electric Smelting & Alum'm Co., Lockport, N. Y.

Mixer for Gold and Silver Sweepings.
Moussette, O. J., Co., Brooklyn, N. Y.

Mold Dryers, Portable (See also Foundry Supplies).
Monarch Engineering & Mfg. Co., Baltimore, Md.
Pangborn Corporation, Hagerstown, Md.
Paxson, J. W., Co., Philadelphia, Pa.

Molds, Ingot (See also Foundry Supplies).
Farrel Foundry & Machine Co., Ansonia, Conn.

Mold Sprayers.
Pangborn Corporation, Hagerstown, Md.
Paxson, J. W., Co., Philadelphia, Pa.
Schweizer, Chas. K., Co., St. Louis, Mo.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Molds, Water-Cooled, for Babbitt, Etc.
Schweizer, Chas. K., Co., St. Louis, Mo.

Molding Machines (See also Foundry Supplies).
Osborn Mfg. Co., Cleveland, O.
Paxson, J. W., Co., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.
Turner Machine Co., Philadelphia, Pa.

Molding Sand (See Sand).

Monel Metal Sheets, Bars, Castings, Etc.
Biddle Hardware Co., Philadelphia, Pa.

Motors (See Dynamos, Etc.).

Muntz's Metal—Sheets, Rods, Bolts, Nails, Etc.
Taunton-New-B'f'd Copper Co., New Bedford, Mass.

Nails (See name of metal wanted).

Name Plates, Etched.
Schweizer, Max, Bridgeport, Conn.

Neutrol.
Berkel, Wm., Chemist Co., Jersey City, N. J.

Nickel.
Bennett-O'Connell Co., Chicago, Ill.
Detroit Platers' Supply Co., Detroit, Mich.
Fitz, Dana & Co., Boston, Mass.
Hanson & Van Winkle Co., Newark, N. J.
Hendricks Bros., New York.
Leavitt, C. W., & Co., New York.
Merchant & Evans Co., Philadelphia, Pa.
Munning-Loeb Co., Matawan, N. J.
Richards & Co., Boston, Mass.
Trotter, Nathan & Co., Philadelphia, Pa.
United States Nickel Co., New Brunswick, N. J.
Wiarda & Co., John C., Brooklyn, N. Y.

Nickel-Bronze Castings and Ingots.
Damascus Bronze Co., Pittsburg, Pa.

Nickel Castings.
Backus & Leeser Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
Munning-Loeb Co., Matawan, N. J.
Wiarda & Co., John C., Brooklyn, N. Y.

Nickel Plating (See Electroplating).

Nickel Salts (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Backus & Leeser Co., New York.
Bennett-O'Connell Co., Chicago, Ill.
Bowers, B. O., Co., New York.
Cooper, Charles & Co., New York.
Detroit Platers' Supply Co., Detroit, Mich.
Haas Manufacturing Co., New York.
Hachmeister-Lind Chemical Co., Pittsburg, Pa.
Hanson & Van Winkle Co., Newark, N. J.
Lang, R. F., New York.
Neubeck, Adolf, Buffalo, N. Y.
McKesson & Robbins, New York.
Munning-Loeb Co., Matawan, N. J.
Stevens Frederic B., Detroit, Mich.
Wiarda & Co., John C., Brooklyn, N. Y.

Nickel Sheets.
Biddle Hardware Co., Philadelphia, Pa.

Nickel, Shot.
Detroit Platers' Supply Co., Detroit, Mich.
Hanson & Van Winkle Co., Newark, N. J.
Seymour Manufacturing Co., The, Seymour, Conn.
United States Nickel Co., New Brunswick, N. J.
Wiarda & Co., John C., Brooklyn, N. Y.

Nickel Silver Tubes.
Wells, A. H. & Co., Waterbury, Conn.

Oil Pumps and Storage Tanks.
Monarch Eng. & Mfg. Co., Baltimore, Md.
Rockwell Co., W. S., New York.

Oil Separators.
American Tool & Machine Co., Boston, Mass.

Oils, Tempering and Lubricating.
Apothecaries Hall Co., Waterbury, Conn.
McKesson & Robbins, New York.
Swan & Finch, New York.

Ovens (See Lacquering, Japanning, Enameling and Sherardizing Ovens. Also Foundry Supplies).

Parting Compounds (See also Foundry Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Hill & Griffith Co., Cincinnati, O.
Osborn Mfg. Co., Cleveland, O.
Stevens, Frederic B., Detroit, Mich.

Pattern Shop Supplies (See Foundry Supplies).

Patterns, Mounted.
Goodale Co., Kalamazoo, Mich.
Turner Machine Co., Philadelphia, Pa.

Peerless Chemical Neutral Salts.
Finkell, Wm. T., New York.

Pewter.
Standard Rolling Mills, Inc., Brooklyn, N. Y.

Persels Pure Nickel Salts.
Bowers, B. O., Co., New York.

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Phosphor Bronze Ingots, Castings, Etc.
Ajax Metal Co., Philadelphia, Pa.
Atkinson Co., The, Rochester, N. Y.
Damascus Bronze Co., Pittsburg, Pa.
Lang, R. F., New York.
Michigan Smelting & Refining Co., Detroit, Mich.
Phosphor Bronze Smelting Co., Philadelphia, Pa.
Riverside Metal Co., Riverside, N. J.
Seymour Mfg. Co., Seymour, Conn.

Phosphor Bronze, Cored Bars.
Atkinson Co., The, Rochester, N. Y.

Phosphor Bronze Sheets, Wire, Rods, Etc.
Bridgeport Brass Co., Bridgeport, Conn.
Phosphor Bronze Smelting Co., Philadelphia, Pa.
Pilling Brass Co., Waterbury, Conn.
Riverside Metal Co., Riverside, N. J.
Seymour Mfg. Co., Seymour, Conn.

Phosphor Copper and Phosphor Tin.
Ajax Metal Co., Philadelphia, Pa.
Atkinson Co., The, Rochester, N. Y.
Damascus Bronze Co., Pittsburg, Pa.
Electric Smelt. & Aluminum Co., Lockport, N. Y.
Lang, R. F., New York.
Michigan Smelting & Refining Co., Detroit, Mich.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Riverside Metal Co., Riverside, N. J.
Roessler & Hasslacher Chemical Co., New York.

Phosphorizers (See Crucibles, Etc.).

Phosphorus (See also Foundry Supplies).
General Chemical Co. Philadelphia, Pa.
McKesson & Robbins, New York.

Pickling Machines, Automatic.
Torrington Manufacturing Co., Torrington, Conn.

Pin Machines (See Automatic Wire and Metal Working Machines).

Plastic Bronze.
Ajax Metal Co., Philadelphia, Pa.
Fitz, Dana & Co., Boston, Mass.

Plated Sheet Metals (See Metals, Plated Sheet).

Platers' Compound (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
International Chemical Co., Camden, N. J.
Swan & Finch Co., New York.
Wiarda & Co., John C., Brooklyn, N. Y.

Platers' Metal (See also Platers' Supplies).
Kemp, W. H., Co., New York.
Pilling Brass Co., Waterbury, Conn.

Platers', Polishers' and Galvanizers' Equipment and Supplies.
Abbott Ball Co., Hartford, Conn.
American Tool & Machine Co., Boston, Mass.
Ames Sword Co., Chicopee, Mass.
Anthony, H. M., Co., New York.
Apothecaries Hall Co., Waterbury, Conn.
Ayer Mfg. Co., New Haven, Conn.
Backus & Leeser Co., New York.
Baltimore Tube Co., Baltimore, Md.
Bennett-O'Connell Co., Chicago, Ill.
Berkel, Wm., Chemical Co., Jersey City, N. J.
Bogue, Chas. J., Electric Co., New York.
Bowers, B. O., Co., New York.
Burns, E. Reed, Brooklyn, N. Y.
Canning, W. & Co., Birmingham, England.
Cleveland Platers' Supply Co., Cleveland, O.
Connecticut Dynamo & Motor Co., Irvington, N. J.
Cooper, Charles, & Co., New York.
Detroit Platers' Supply Co., Detroit, Mich.
Finkell, Wm. T., New York.
Gardner Machine Co., Beloit, Wis.
Globe Machine & Stamping Co., Cleveland, O.
Haas Manufacturing Co., New York.
Hachmeister-Lind Chemical Co., Pittsburg, Pa.
Hanson & Van Winkle Co., Newark, N. J.
Hill & Griffith Co., Cincinnati, O.
International Chemical Co., Camden, N. J.
Lang, R. F., New York.
Leiman Bros., New York.
L'Hommedieu, C. F., & Sons Co., Chicago, Ill.
Meaker Company, Chicago, Ill.
Metal Treating & Equipment Co., New York.
McKesson & Robbins, New York.
Munning-Loeb Co., Matawan, N. J.
Neubeck, Adolf, Buffalo, N. Y.
No-Dust Drying Machine Co., Providence, R. I.
Oriental Rouge Co., Bridgeport, Conn.
Osborn Mfg. Co., Cleveland, O.
Peckham Mfg. Co., Newark, N. J.
Roessler & Hasslacher Chemical Co., New York.
Rojas Chemical Co., New York.
Smith, Richardson Co., Attleboro, Mass.
Stevens, Frederic B., Detroit, Mich.
Swan & Finch Co., New York.
Tolhurst Machine Works, Troy, N. Y.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.
Wiarda & Co., John C., Brooklyn, N. Y.
Williamsville Buff Mfg. Co., Danielson, Conn.
Woodison, E. J., Co., Detroit, Mich.
Wyckoff, H. S., Co., Newark, N. J.

Plating Barrels and Apparatus (See also Platers' Supplies).
Abbott Ball Co., Hartford, Conn.
American Tool & Machine Co., Boston, Mass.
Backus & Leeser Co., New York.
Bennett-O'Connell Co., Chicago, Ill.
Bowers, B. O., Co., New York.
Connecticut Dynamo & Motor Co., Irvington, N. J.
Detroit Platers' Supply Co., Detroit, Mich.
Globe Machine & Stamping Co., Cleveland, O.
Hanson & Van Winkle Co., Newark, N. J.
L'Hommedieu, C. F., & Sons Co., Chicago, Ill.
Metal Treating & Equipment Co., New York.
Munning-Loeb Co., Matawan, N. J.
Smith, Richardson Co., Attleboro, Mass.
Stevens, Frederic B., Detroit, Mich.
Tolhurst Machine Works, Troy, N. Y.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.
Woodison, E. J., Co., Detroit, Mich.

Plating, Job.
Autoyre Co., Oakville, Conn.
Hassall, John, Inc., Brooklyn, N. Y.
Neubeck, Adolf, Buffalo, N. Y.
Trichlinger, J., New York.
Waterbury Metal Products Co., Waterbury, Conn.

Plating Solutions.
Berkel, Wm., Chemical Co., Jersey City, N. J.
Rojas Electro Chemical Co., New York.

Platinum, Sheet and Wire.
Roessler & Hasslacher Co., New York.

Platinum Scrap, Buyers of.
Radnai, Josef, New York.
Roessler & Hasslacher Co., New York.

Plumbago (See Graphite).

Pneumatic Tool Hose and Supplies.
Harrison Supply Co., Boston, Mass.

Pointing Machines (See Automatic Wire and Metal Working Machinery).

Polishing and Buffing Compositions (See also Platers' Supplies).
Hanson & Van Winkle Co., Newark, N. J.
Hill & Griffith Co., Cincinnati, O.
Munning-Loeb Co., Matawan, N. J.
Williamsville Buff Mfg. Co., Danielson, Conn.
Zucker, Geo., Co., Newark, N. J.

Polishing, Buffing and Burnishing Machinery and Appliances (See also Platers' Supplies).
Abbott Ball Co., Hartford, Conn.
American Tool & Machine Co., Boston, Mass.
Ames Sword Co., Chicopee, Mass.
Apothecaries Hall Co., Waterbury, Conn.
Backus & Leeser Co., New York.
Baltimore Tube Co., Baltimore, Md.
Bennett-O'Connell Co., Chicago, Ill.
Buchanan, Thos., Co., Cincinnati, O.
Cleveland Blow Pipe Co., Cleveland, O.
Cleveland Platers' Supply Co., Cleveland, O.
Connecticut Dynamo & Motor Co., Irvington, N. J.
Detroit Platers' Supply Co., Detroit, Mich.
Gardner Machine Co., Beloit, Wis.
Globe Machine & Stamping Co., Cleveland, O.
Hachmeister-Lind Chemical Co., Pittsburg, Pa.
Hanson & Van Winkle Co., Newark, N. J.
Kirk & Blum, Cincinnati, O.
Knickerbocker Co., Jackson, Mich.
Leiman Bros., New York.
L'Hommedieu, C. F., & Sons, Co., Chicago, Ill.
Munning-Loeb Co., Matawan, N. J.
No-Dust Drying Machine Co., Providence, R. I.
Northern Blower Co., Cleveland, O.
Osborn Mfg. Co., Cleveland, O.
Peckham Mfg. Co., Newark, N. J.
Pfleghar Hardware Sp'lty Co., New Haven, Conn.
Stevens, Frederic B., Detroit, Mich.
Tolhurst Machine Works, Troy, N. Y.
Williamsville Buff Mfg. Co., Danielson, Conn.
Woodison, E. J., Co., Detroit, Mich.
Wyckoff, H. S., Co., Newark, N. J.

Polishing (See Electroplating, Polishing, Etc.).

Polishing Belts, Endless (See also Platers' Supplies).
Ames Sword Co., Chicopee, Mass.

Polishing Meal for Dry Tumbling.
Peckham Mfg. Co., Newark, N. J.

Polishing Rouge (See also Platers' Supplies).
Hanson & Van Winkle Co., Newark, N. J.
Zucker, Geo., Co., Newark, N. J.

Potash (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Cooper, Charles, & Co., New York.
Detroit Platers' Supply Co., Detroit, Mich.
Hachmeister-Lind Chemical Co., Pittsburgh, Pa.
International Chemical Co., Camden, N. J.
McKesson & Robbins, New York.
Niagara Alkali Co., Niagara Falls, N. Y.
Wiarda & Co., John C., Brooklyn, N. Y.

Potassium Silver Cyanide.
Berkel, Wm., Chemical Co., Jersey City, N. J.

Presses, Bench and Foot
Bliss, E. W., Company, Brooklyn, N. Y.
Leiman Bros., New York.
Shuster, The F. B., Co., New Haven, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Presses, Cabbaging.
Farrel Foundry & Machine Co., Ansonia, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Wood, R. D., & Co., Philadelphia, Pa.

Presses, Coining.
Bliss, E. W., Co., Brooklyn, N. Y.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Presses, Drop.
Bliss, E. W., Co., Brooklyn, N. Y.
Peck Drop Press Works, New Haven, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Presses, Drop Lifters for.
Peck Drop Press Works, New Haven, Conn.

Presses, Filter.
American Tool & Machine Co., Boston, Mass.

Presses, Power.
Bliss, E. W., Co., Brooklyn, N. Y.
Farrel Foundry & Machine Co., Ansonia, Conn.
Garrison, A., Foundry Co., Pittsburgh, Pa.
Peck Drop Press Works, New Haven, Conn.
Torrington Manufacturing Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Watson-Stillman Co., New York.
Wood, R. D., & Co., Philadelphia, Pa.

Pressure Blowers (See also Foundry Supplies).
Eclipse Air Brush & Compressor Co., Newark, N. J.
Eureka Pneumatic Spray Co., New York.
Kenworthy, Chas. F., Waterbury, Conn.
Leiman Bros., New York.
Monarch Eng. & Mfg. Co., Baltimore, Md.

Pumice (See Platers', Polishers' and Galvanizers' Supplies).

Pyrometers.
Bristol & Co., The, Waterbury, Conn.

Recording Instruments for Heat, Pressure, Etc.
Bristol & Co., The, Waterbury, Conn.

Riddles (See also Foundry Supplies).
Stevens, Frederic B., Detroit, Mich.

Rifled Tubing.
Baltimore Tube Co., Baltimore, Md.

Riveting Machines.
Shuster, The F. B., Co., New Haven, Conn.
Wood, R. D., & Co., Philadelphia, Pa.

Rivets—Brass, Aluminum, Etc.
Hassall, John, Inc., New York.
Hendricks Bros., New York.
Kemp, W. H., Co., New York.

Rojas Process of Electro Deposition.
Rojas Electro-Chemical Co., New York.

Roll-Grinding Machines.
Farrel Foundry & Machine Co., Ansonia, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Rolls, Chilled and Sand.
Engineering Products Co., New York.
Farrel Foundry & Machine Co., Ansonia, Conn.
Garrison, A., Fdy. & Machine Co., Pittsburg, Pa.
Torrington (Conn.) Farrel Foundry & Machine Co.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Rolls, Jewelers'.
Leiman Bros., New York.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Rolling Mill Machinery.
Engineering Products Co., New York.
Farrel Foundry & Machine Co., Ansonia, Conn.
Garrison, A., Fdy. & Machine Co., Pittsburg, Pa.
Thompson, Gulon, Waterbury, Conn.
Thompson, Hugh L., Waterbury, Conn.
Torrington Manufacturing Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Rouge (See also Platers' Supplies).
Munning-Loeb Co., Matawan, N. J.
Zucker, Geo., Co., Newark, N. J.

Salt Water Gold Plating Outfits.
Wyckoff, H. S., Co., Newark, N. J.

Sand, Fire (See also Foundry Supplies).
Pangborn Corporation, Hagerstown, Md.
Paxson, J. W., Co., Philadelphia, Pa.

Sand for Blasting.
Paxson, J. W., Co., Philadelphia, Pa.

Sand Blast Machinery and Equipment.
Leiman Bros., New York.
Pangborn Corporation, Hagerstown, Md.
Paxson, J. W., Co., Philadelphia, Pa.
Sly, W. W., Mfg. Co., Cleveland, O.
Stevens, Frederic B., Detroit, Mich.

Sand Blast Systems.
Pangborn Corporation, Hagerstown, Md.
Paxson, J. W., Co., Philadelphia, Pa.
Sly, W. W., Mfg. Co., Cleveland, O.

Sand Blast Tumbling Barrels.
Pangborn Corporation, Hagerstown, Md.
Paxson, J. W., Co., Philadelphia, Pa.
Sly, W. W., Mfg. Co., Cleveland, O.

Sand Dryers, Sifters and Mixers (See also Foundry Supplies).
Osborn Mfg. Co., Cleveland, O.
Pangborn Corporation, Hagerstown, Md.
Turner Machine Co., Philadelphia, Pa.

Sand Handling & Conveying Machinery.
Pangborn Corporation, Hagerstown, Md.

Sand, Molding (See also Foundry Supplies).
Pangborn Corporation, Hagerstown, Md.
Paxson, J. W., Co., Philadelphia, Pa.

Sawdust, Boxwood, for Drying Purposes (See also Platers' Supplies).
Bennett-O'Connell Co., Chicago, Ill.
Hanson & Van Winkle Co., Newark, N. J.
Sommers, John, Faucet Co., Newark, N. J.

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Sawdust Drying-out Boxes (See also Platers' Supplies).
Bennett-O'Connell Co., Chicago, Ill.
Hanson & Van Winkle Co., Newark, N. J.
Munning-Loeb Co., Matawan, N. J.
No-Dust Drying Machine Co., Providence, R. I.
Smith, Richardson Co., Attleboro, Mass.
Steiner, E. E., Newark, N. J.

Scrap Metal (See Metal Turnings, Drosses, Residues, Etc.).

Screw Machine Work.
Schroeder, Edw., Lamp Works, Jersey City, N. J.

Shears, Power.
Bliss, E. W., Co., Brooklyn, N. Y.
Farrel Foundry & Machine Co., Ansonia, Conn.
Garrison, A., Fdy. & Machine Co., Pittsburg, Pa.
Torrington Manufacturing Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Watson-Stillman Co., New York.
Wood, R. D., & Co., Philadelphia, Pa.

Sheet Metal Novelties.
Autoyre, The, Co., Oakville, Conn.

Sheet Metal Parts.
Autoyre, The, Co., Oakville, Conn.

Sheet Metals, Decorated.
Hirsch, L. C., & Co., New York.

Sheet Metal Straightening, Cutting and Forming Machinery.
Bliss, E. W., Co., Brooklyn, N. Y.
Farrel Foundry & Machine Co., Ansonia, Conn.
Shuster, The F. B., Co., New Haven, Conn.
Torrington Manufacturing Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Sherardizing (See also Galvanizing).
Globe Machine & Stamping Co., Cleveland, O.

Sherardizing Ovens.
Gehnrich, Hermann, New York.
Globe Machine & Stamping Co., Cleveland, O.
Monarch Engineering & Mfg. Co., Baltimore, Md.

Shoes, Aluminum Safety.
Racine Aluminum Shoe Co., Racine, Wis.

Shop Furniture, Etc.
Sly, W. W., Mfg. Co., Cleveland, O.

Silicon.
Leavitt, C. W., & Co., New York.

Silicon Copper.
Ajax Metal Co., Philadelphia, Pa.
Damascus Bronze Co., Pittsburg, Pa.
Electric Smelting & Alum'm Co., Lockport, N. Y.
Lang, R. F., New York.
Roessler & Hasslacher Chemical Co., New York.

Silver and Gold, Granulated.
Jackson, John J., & Co., Newark, N. J.
Ney, J. M., Co., Hartford, Conn.

Silver Cyanide.
Berkel, Wm., Chemical Co., Jersey City, N. J.

Silver, Nitrate and Chloride of (See also Platers' Supplies).
Jackson, John J., & Co., Newark, N. J.

Silver Ingots, Bars, Plates, Etc.
Ney, J. M., Co., Hartford, Conn.
Renziehausen, Wm. F., Co., Newark, N. J.

Silver Refiners.
Jackson, John J., & Co., Newark, N. J.
Ney, J. M., Co., Hartford, Conn.
Renziehausen, Wm. F., Co., Newark, N. J.

Silver, Rolled Sterling.
Jackson, John J., & Co., Newark, N. J.
Ney, J. M., Co., Hartford, Conn.
Renziehausen, Wm. F., Co., Newark, N. J.
Riverside Metal Co., Riverside, N. J.

Silver Solder.
Jackson, John J., & Co., Newark, N. J.
Ney, J. M., Co., Hartford, Conn.

Silver Wire.
Jackson, John J., & Co., Newark, N. J.

Slitting Machines.
Engineering Products Co., New York.

Smelters of Copper-Bearing Materials.
Ajax Metal Co., Philadelphia, Pa.
Balbach Smelting & Refining Co., Newark, N. J.

Smelters, Sweep.
Ney, J. M., Co., Hartford, Conn.
Renziehausen, Wm. F., Co., Newark, N. J.

Soap (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
International Chemical Co., Camden, N. J.
Wyckoff, H. S., Co., Newark, N. J.

Solder, Aluminum.
Aluminum Company of America, Pittsburg, Pa.
Atkinson Co., The, Rochester, N. Y.
Electric Smelt. & Aluminum Co., Lockport, N. Y.
Kemp, W. H., Co., New York.
Richards & Co., Boston, Mass.
U. S. Reduction Co., Chicago, Ill.

Solder, Brazing.
Ajax Metal Co., Philadelphia, Pa.
Delaware Metal Refinery, Philadelphia, Pa.
Fitz, Dana & Co., Boston, Mass.
Hussey, C. G., & Co., Pittsburg, Pa.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Trenton Smelting & Refining Co., Trenton, N. J.

Solder, Hard, for Cast Iron.
Lang, R. F., New York.

Solder, Wire.
Brooks Solder & Metal Works, Baltimore, Md.
Standard Rolling Mills Inc., Brooklyn, N. Y.

Soldering Flux.
Richards & Co., Boston, Mass.

Soldering Irons.
Hendricks Bros., New York.
Hussey, C. G., & Co., Pittsburg, Pa.
Taunton-New B'f'd Copper Co., New Bedford, Mass.

Solder Molds.
Schweizer, Chas. K., Co., St. Louis, Mo.

Solder, Silver.
Jackson, John J., & Co., Newark, N. J.

Solder Testing Scales.
Delaware Metal Refinery, Philadelphia, Pa.

Solder, Tinners'.
Atkinson Co., The, Rochester, N. Y.
Brooks Solder & Metal Works, Baltimore, Md.
Columbia Smelting & Refining Works, New York.
Delaware Metal Refinery, Philadelphia, Pa.
Fitz, Dana & Co., Boston, Mass.
Michigan Smelting & Refining Co., Detroit, Mich.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Riverside Metal Refining Co., Connellsville, Pa.
Standard Rolling Mills Inc., Brooklyn, N. Y.

Soluble Cotton.
International Smokeless Powder & Chemical Co., New York.
New Era Lustre Co., New York.
Wiarda & Co., John C., Brooklyn, N. Y.

Spelter.
Birkenstein, S., & Sons, Chicago, Ill.
Brooks Solder & Metal Works, Baltimore, Md.
Damascus Bronze Co., Pittsburg, Pa.
Fitz, Dana & Co., Boston, Mass.
Genesee Metal Co., Rochester, N. Y.
Hegeler Bros., Danville, Ill.
Hendricks Bros., New York.
Illinois Zinc Co., Peru, Ill.
Leavitt, C. W., & Co., New York.
Matthiesen & Hegeler Zinc Co., La Salle, Ill.
Michigan Smelting & Refining Co., Detroit, Mich.
New Jersey Zinc Co., The, New York.
Richards & Co., Boston, Mass.
Trenton Smelting & Refining Co., Trenton N. J.
Trotter, Nathan, & Co., Philadelphia, Pa.
U. S. Reduction Co., Chicago, Ill.
Walsh's Sons, M. I., & Co., Newark, N. J.

Spelter Kettles (See Crucibles, etc.).

Spinning Lathes.
Bliss, E. W., Company, Brooklyn, N. Y.
Prylbil, P., Inc., New York.
Wilcor Manufacturing Co., Chicago, Ill.

Spinning, Metal.
Aluminum Goods Mfg. Co., Manitowoc, Wis.
Eberhard, George, Providence, R. I.
Riverside Metal Co., Riverside, N. J.
Standard Rolling Mills, Inc., Brooklyn, N. Y.
Waterbury Metal Products Co., Waterbury, Conn.

Spraying Hoods, Tables, Etc.
Eureka Pneumatic Spray Co., New York.

Spraying Machines.
Eclipse Air Brush & Compressor Co., Newark, N. J.
Eureka Pneumatic Spray Co., New York.
Nikolas, G. J., & Co., Chicago, Ill.
Pangborn Corporation, Hagerstown, Md.

Sprue Cutters (See also Foundry Supplies).
Bliss, E. W., Co., Brooklyn, N. Y.
Shuster, The F. B., Company, New Haven, Conn.
Smith, J. D., Foundry Supply Co., Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Turner Machine Co., Philadelphia, Pa.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Stampings, Metal.
Aluminum Goods Mfg. Co., Manitowoc, Wis.
Globe Machine & Stamping Co., Cleveland, O.
Riverside Metal Co., Riverside, N. J.
Standard Rolling Mills Inc., Brooklyn, N. Y.
Waterbury Metal Products Co., Waterbury, Conn.

Steel Sheets, Plated.
Hirsch, L. C., & Co., New York.

Steel Shop Fittings and Furniture.
Sly, W. W., Mfg. Co., Cleveland, O.

Steel Tubing, Thin Gauges.
Baltimore Tube Co., Baltimore, Md.

Sterling Silver Sheets.
Jackson, John J., Newark, N. J.

Stirrers, Graphite (See Crucibles, etc.).

Stoneware, Chemical.
German-American Stoneware Works, New York.

Stoneware Exhaust Fans.
German-American Stoneware Works, New York.

Stoneware Tanks, Dipping Baskets, etc.
German-American Stoneware Works, New York

Strip Steel in Coils.
Hirsch, L. C., & Co., New York.

Sulphuret Potash.
Finkell, Wm. T., New York.

Sweep Smelters Mixing Machine.
Moussette, O. J., Co., Brooklyn, N. Y.

Sweep Smelters (See Smelters, Sweep).

Tacks (See name of metal wanted).

Tanks, Electroplaters' (See also Platers' Supplies).
Backus & Leeser Co., New York.
Bennett-O'Connell Co., Chicago, Ill.
Chadwick-Boston Lead Co., Boston, Mass.
Detroit Platers' Supply Co., Detroit, Mich.
German-American Stoneware Works, New York.
Hanson & Van Winkle Co., Newark, N. J.
Munning-Loeb Co., Matawan, N. J.
Schwarzwalder, J., & Sons, Inc., Hoboken, N. J.
Stearns, The, A. T., Lumber Co., Boston, Mass.
Wiarda & Co., John C., Brooklyn, N. Y.

Tanks, Stoneware.
German-American Stoneware Works, New York.

Testing Laboratories.
Dover Laboratory, Dover, N. J.
Ledoux & Co., New York.
Robinson, Louis G., Cincinnati, O.

Testing Scales, White Metal.
Delaware Metal Refinery, Philadelphia, Pa.

Tin, Chloride of.
Wiarda & Co., John C., Brooklyn, N. Y.

Tinning Machines.
Globe Machine & Stamping Co., Cleveland, O.
Hanson & Van Winkle Co., Newark, N. J.
Meaker Co., The, Chicago, Ill.
U. S. Electro Galvanizing Co., Brooklyn, N. Y.

Tin, Pig, Bar and Block.
Birkenstein, S., & Sons, Chicago, Ill.
Brook Solder & Metal Works, Baltimore, Md.
Fitz, Dana & Co., Boston, Mass.
Hendricks Bros., New York.
Leavitt, C. W., & Co., New York.
Michigan Smelting & Refining Co., Detroit, Mich.
Richards & Co., Boston, Mass.
Standard Rolling Mills Inc., Brooklyn, N. Y.
Trotter, Nathan, & Co., Philadelphia, Pa.
U. S. Reduction Co., Chicago, Ill.

Tin Pipe.
Michigan Smelting & Refining Co., Detroit, Mich.

Tin, Sheet Block.
Standard Rolling Mills Inc., Brooklyn, N. Y.

Tin Sheets, Plated.
Hirsch, L. C., & Co., New York.

Tobin Bronze.
American Brass Co., Waterbury, Conn.

Tripoli Compositions (See also Platers' and Polishers' Supplies).
Ayer Mfg. Co., New Haven, Conn.
Hachmeister-Lind Chemical Co., Pittsburg, Pa.
Hanson & Van Winkle Co., Newark, N. J.
Hill & Griffith Co., Cincinnati, O.
Munning-Loeb Co., Matawan, N. J.
Williamsville Buff Mfg. Co., Danielson, Conn.
Zucker, Geo., Co., Newark, N. J.

Tripoli Flour (See also Platers' Supplies).
Apothecaries Hall Co., Waterbury, Conn.
Cooper, Charles, & Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
Munning-Loeb Co., Matawan, N. J.
McKesson & Robbins, New York.
Stevens, Frederic B., Detroit, Mich.
Wiarda & Co., John C., Brooklyn, N. Y.
Williamsville Buff Mfg. Co., Danielson, Conn.

Trisalyt Triple Salt.
Roessler & Hasslacher Chemical Co., New York.

Tumbling Barrels, Leather for Dry.
Peckham Mfg. Co., Newark, N. J.

Tube Bending Machines.
Baltimore Tube Co., Baltimore, Md.

Tube Machinery.
Farrel Foundry & Machine Co., Ansonia, Conn.
Lewis, Jos. E., Baltimore, Md.
Torrington Mfg. Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Tube Polishing Machines.
Baltimore Tube Co., Baltimore, Md.

Tubes (See name of metal wanted).

Tumbling Barrels (See also Foundry Supplies and Platers' Supplies).
and Platers' Supplies.)
Abbott Ball Co., Hartford, Conn.
Bennett-O'Connell Co., Chicago, Ill.
Detroit Platers' Supply Co., Detroit, Mich.
Globe Machine & Stamping Co., Cleveland, O.
Hanson & Van Winkle Co., Newark, N. J.
Osborn Mfg. Co., Cleveland, O.
Pangborn Corporation, Hagerstown, Md.
Paxson, J. W., Co., Philadelphia, Pa.
Sly, W. W., Mfg. Co., Cleveland, O.
Stevens, Frederic B., Detroit, Mich.
Waterbury (Conn.) Farrel Foundry & Machine Co.
Woodison, E. J., Co., Detroit, Mich.

Type Metal.
Ajax Metal Co., Philadelphia, Pa.
Brooks Solder & Metal Works, Baltimore, Md.
Columbia Smelting & Refining Works, New York.
North American Smelting Co., Philadelphia, Pa.
Richards & Co., Boston, Mass.
Riverside Metal Refining Co., Connellsville, Pa.
Standard Rolling Mills Inc., Brooklyn, N. Y.

Vienna Lime Compositions (See also Platers', Polishers' and Galvanizers' Supplies).
Ayer Mfg. Co., New Haven, Conn.
Bennett-O'Connell Co., Chicago, Ill.
Hanson & Van Winkle Co., Newark, N. J.
Munning-Loeb Co., Matawan, N. J.
Williamsville Buff Mfg. Co., Danielson, Conn.
Zucker, Geo., Co., Newark, N. J.

Voltmeters (See also Platers', Polishers' and Galvanizers' Supplies).
Bennett-O'Connell Co., Chicago, Ill.
Bristol C., The, Waterbury, Conn.
Hanson & Van Winkle Co., Newark, N. J.

Waldberg's Nickel Salts.
Bowers, B. O., Co., New York.

Waste Washing Machines.
American Tool & Machine Co., Boston, Mass.

Wattmeters.
Bristol, The, Co., Waterbury, Conn.

Wax Wire (See also Foundry Supplies).
Stevens, Frederic B., Detroit, Mich.

Whale Oil Soap.
Apothecaries Hall Co., Waterbury, Conn.
Bennett-O'Connell Co., Chicago, Ill.
Hanson & Van Winkle Co., Newark, N. J.
Munning-Loeb Co., Matawan, N. J.
International Chemical Co., Camden, N. J.
Swan & Finch Co., New York.

White Finish (See also Platers' Supplies).
Hachmeister-Lind Chemical Co., Pittsburg, Pa.
Zucker, Geo., Co., Newark, N. J.

White Metal Ingots and Castings.
Ajax Metal Co., Philadelphia, Pa.
Brooks Solder & Metal Works, Baltimore, Md.
Columbia Smelting & Refining Works, New York.
Delaware Metal Refinery, Philadelphia, Pa.
Riverside Metal Refining Co., Connellsville, Pa.
Standard Rolling Mills Inc., Brooklyn, N. Y.

White Metal Rolling for the Trade.
Standard Rolling Mills Inc., Brooklyn, N. Y.

White Metal Testing Scales.
Delaware Metal Refinery, Philadelphia, Pa.

Wire (See name of metal wanted).

Wire Forms.
Autoyre, The, Co., Oakville, Conn.

Wire Goods Manufacturers (See also Metal Goods Made to Order).
Autoyre, The, Co., Oakville, Conn.
Campbell-Warner Co., Middletown, Conn.

Wire Mill Equipment.
Farrel Foundry & Machine Co., Ansonia, Conn.
Torrington Mfg. Co., Torrington, Conn.
Waterbury (Conn.) Farrel Foundry & Machine Co.

Wire Nails, All Metals.
Hassall, John, Inc., New York.

Wire Specialties and Novelties.
Autoyre, The, Co., Oakville, Conn.

Wire Straightening and Forming Machinery.
Bliss, E. W., Co., Brooklyn, N. Y.
Shuster, The F. B., Co., New Haven, Conn.

Wire Wheel and Hand Brushes (See also Foundry Supplies).
Blumenthal, Hermann, & Co., New York.
Gornell, E., & Sons, Chicago, Ill.
Hanson & Van Winkle Co., Newark, N. J.
Manufacturers' Brush Co., Cleveland, O.
Osborn Mfg. Co., Cleveland, O.
Paxson, J. W., Co., Philadelphia, Pa.
Stevens, Frederic B., Detroit, Mich.

Zinc Battery Plates.
Matthiesen & Hegeler Zinc Co., La Salle, Ill.

Zinc, Chloride of (See also Platers' Supplies).
Bennett-O'Connell Co., Chicago, Ill.
Cooper, Charles, & Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
Richards & Co., Boston, Mass.
Wiarda & Co., John C., Brooklyn, N. Y.

Zinc, Cold Rolled, in Coil.
Platt Bros. Co., Waterbury, Conn.

Zinc Dust (See also Platers' Supplies).
Cooper, Charles, & Co., New York.
Globe Machine & Stamping Co., Cleveland, O.
Hachmeister-Lind Chemical Co., Pittsburg, Pa.
Hanson & Van Winkle Co., Newark, N. J.
Leavitt, C. W., & Co., New York.
McKesson & Robbins, New York.
Wiarda & Co., John C., Brooklyn, N. Y.

Zinc Salts, Commercial (See also Platers' Supplies).
Bennett-O'Connell Co., Chicago, Ill.
Cooper, Charles, & Co., New York.
Hanson & Van Winkle Co., Newark, N. J.
Wiarda & Co., John C., Brooklyn, N. Y.

Zinc Sheet and Plate.
Hirsch, L. C., & Co., New York.
Illinois Zinc Co., Peru, Ill.
Matthiesen & Hegeler Zinc Co., La Salle, Ill.
National Sheet Metal Co., Peru, Ill.
Pilling Brass Co., Waterbury, Conn.
Platt Bros. Co., Waterbury, Conn.
Richards & Co., Boston, Mass.

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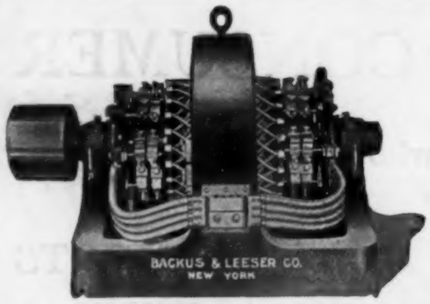

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